

**Newcastle Disease and Village Chickens in
Other Parts of Asia and Africa**

Newcastle Disease in Village Chickens in North, West and Central Africa

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Abstract

Throughout Africa, Newcastle disease (ND) is reported to be the single greatest pathological constraint in village chickens. The results of prevalence studies in Morocco, Mauritania, Benin and Cameroon are reviewed. In each case, unvaccinated chickens were found to be seropositive and, where virus isolation was attempted, velogenic ND virus was found. The results indicate a high prevalence of the virus throughout the regions studied.

A vaccination trial undertaken in villages in Morocco showed that vaccination with live or inactivated vaccines could largely protect against the mortality seen in the control village.

At a Centre Technique Agricole international seminar on small-holder rural poultry production held in Thessaloniki, Greece, in October 1990 — at which a majority of countries in Africa were represented — all countries reported Newcastle disease as being the single greatest pathological constraint.

In this communication, the results of prevalence studies in Morocco, Mauritania, Benin and Cameroon are presented and the results of a vaccination trial in Morocco summarised. Although these results have already been presented in Europe (Bell 1991) they are repeated here in order to permit comparison of the situations in Africa and Asia and discussion with our Asian colleagues.

Prevalence Studies

Village chicken flocks in six different regions of Morocco were studied for the presence of ND (Bell and Mouloudi 1988). Three of the regions contained commercial poultry farming and three were isolated mountainous regions with no commercial poultry farming. Serum samples and tracheal swabs were taken from 100 chickens in each region. Antibodies against ND virus (NDV) were found in chickens from every region. Forty-one isolates of NDV were obtained, including some from chickens in every region. Two virus isolates from each region were characterised and all were found to be velogenic. Thus,

village chicken flocks throughout Morocco harbour a reservoir of virulent NDV, independently of commercial farms.

A similar survey was undertaken in Mauritania (Bell et al. 1990b). Serum samples and tracheal swabs were taken from 80 chickens in village poultry flocks in each of three different regions. Antibodies against NDV were detected in 4.6% of chickens. Six isolates of NDV were made, of which four formed plaques on chicken fibroblast monolayers, indicating virulence.

In Cameroon (Agbede et al. 1991), blood samples were taken from 60 chickens in each of three regions, comprising equatorial forest in the east, a mountainous region in the west, and a savanna region in the north. Seropositivities for NDV were 52%, 48% and 47% respectively, with an overall mean of 49%.

In Benin (C.A.A.M. Chrysostome et al. unpublished data), seropositivities for NDV of 56%, 75% and 69% were obtained in village chickens in three ecologically different zones in the south, centre and north of the country, respectively. In both Cameroon and Benin, a wide range of titres was observed.

The seropositivity in the absence of vaccination and the virus isolations show that NDV is present in village poultry in all four countries studied. That these results are typical for Africa as a whole was suggested at the recent meeting in Greece. While other pathogens are present, in the face of the high mortality caused by ND they are much less significant. In addition, the non-intensive rearing conditions mean that their effects are less marked than they would be in intensive farms.

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Vaccination Trial

All the poultry in each of four distinct Moroccan villages were vaccinated against ND using Hitchner B1 and inactivated vaccines (Bell et al. 1990a). Poultry in a fifth village were monitored as controls. Mortality in the poultry was followed for 20 weeks after the first vaccination and blood samples were taken every 4 weeks from chickens for estimation of antibodies against NDV. Sixty-three percent of the chicken population and 60% of the turkey population in the control village died during the 20 weeks of observation. Necropsied birds showed lesions consistent with ND. Mortality did not exceed 22% in the vaccinated villages.

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The Productivity and Nutrition of Village Chickens in Sri Lanka

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Abstract

About 15% of the national egg production in Sri Lanka is derived from village chickens. Observations were made on the production characteristics of village chickens and the feed resource base available in the village. About half the families in the four villages that were studied kept village chickens. The average flock size was about 10 birds. The hen day production was 30% and the hatching rate was 67%. The mortality rate was 65% in chicks to 70 days of age. Household refuse comprised more than 70% of the crop content of village hens. It is suggested that productivity could be increased at small cost by reducing the mean age of the hen flock, by better control of laying sites and by giving young chicks preferential access to household scraps.

THE total poultry population in Sri Lanka is about 9 million birds (Livestock Census and Statistics 1989) consisting of intensively reared improved exotic birds and extensively kept native village chickens. The number under village poultry systems has been estimated at a little over 2.5 million (Fonseka 1987). This number has remained static for several years. At present, village poultry contributes about 15% of national egg production; its share of the poultry meat supply is not known.

The village chicken found today is a descendant of the jungle fowl (*Gallus gallus*) of Southeast Asia. Although there has been an introduction of exotic genotypes to the country at various times, their impact in upgrading the village chicken has been minimal. Therefore, some of the distinct features of their ancestors still remain to give them a separate identity as 'village chickens'.

The rearing of village chickens is prevalent in rural areas, where the social and economic standards of the people are generally lower than in the urban areas. Further, unemployment is high and female labour is often underutilised. Therefore, poultry keeping helps to supplement incomes and the nutritional status of those families. The rearing of village chickens requires little or no inputs, hence it remained less affected by the constraints applicable to intensive farming. This is very

important to developing countries like Sri Lanka where most of the poultry feed ingredients are imported.

Although village chickens make a large contribution to the social, cultural, nutritional and economic needs of rural farmers, the industry has been overlooked in the past. Basic information on productivity and nutrition of these birds and their contribution to rural life had not been assessed. The study reported here therefore sought to investigate the production characteristics and feed resource base for village chickens. Some aspects of the socio-economic background of farming families were also studied. It was hoped that the study would primarily help to fill the present information gap and also provide the foundation needed for any future development programs seeking to optimise village chicken production.

Materials and Methods

Four villages close to the Veterinary Research Institute, Peradeniya, were selected for the study. The village chicken production system was surveyed in 34 families for one year. During the year, one family which was already keeping some hybrid hens opted for small-scale intensive egg production, six families sold out, the flock of one family died and one householder became ill. The production data were derived from the remaining 25 flocks. Each family was given a data sheet to record inputs and production from their flocks. The information was collected during fortnightly visits to the household. The

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scavenging activities of each of 15 hens were recorded in the field during a full day. The next day those hens were collected from the field late in the morning while scavenging, and taken immediately to the laboratory where blood was collected for calcium and phosphorus determinations, after which they were killed with thiopentone sodium. The contents of the crop and gizzard were collected, weighed and identified visually. The relative contribution of each item of the diet was determined by weighing. Full-day collections of refuse from individual households were made on 14 occasions, weighed, identified visually and analysed.

Proximate composition analyses were done by the standard AOAC (1970) procedures. Calcium in feed and crop samples was determined by the method of Rowe (1983). Calcium in plasma was determined with a diagnostic kit (Hoffman, La Roche and Co. Ltd.; Basle, Switzerland). Plasma phosphorus was measured by a modification of the method of Fiske and Subba Row (1925).

Results

Socioeconomic background

Approximately half of the families in the four villages in which the study was conducted kept village chickens. Twenty-nine of the households keeping records had primary education, four had secondary education and there was one graduate. None had knowledge of poultry keeping, nor did they normally keep written records of their flocks. Nine were tradesmen, two were employed in retail business, three were students, ten were labourers and ten were unemployed.

Twenty-two percent of families kept chickens only for eggs for family consumption. The remainder of the families consumed some of the eggs and sold the rest. Eggs were sold only to neighbours at prices 10–20% higher than the larger commercial eggs. The difference in price is attributed to better flavour, colour and nutritive value. One family ate their own chickens, but the others bought or sold birds for consumption for festive occasions. The prices paid were also higher than those paid for intensively reared birds. Usually, the women received the income from the flocks, and used it mainly for food and school requisites.

Husbandry

All households reared their own replacement chickens and had a simple night shelter on the ground for them. This was made from local materials such as bamboo slats, wattle and mud, and palm leaves. Only one household had a nest in the night shelter; all of the others had a nest in the family house where it doubled for laying and for incubating eggs. The birds were released for 11.7 ± 0.5 hours each day,

virtually all the daylight hours. No water was provided, the chickens being dependent on domestic slops and puddles. No special provision was made for feeding, and the household refuse was disposed of out the door as it became available. Refuse was usually disposed of twice a day, once before 0830 h and at a second time either in late morning or late afternoon. The birds, presumably familiar with the routine of household food preparation, were usually gathered around the doorway prepared for disposal. Three families provided a small quantity of commercial starter ration for their young chicks.

Flock composition

The birds appeared to be typical village chickens with mixed coloured plumage. The average flock size was:

chicks (0–8 weeks)	2.4 ± 4.8
pullets (8 weeks to laying)	1.4 ± 2.0
cockerels (8 weeks to maturity)	2.3 ± 1.5
laying hens	4.0 ± 2.1

Setting of eggs

Eggs for setting were collected in the household over several days, then all placed simultaneously under a broody hen. No selection was exercised over the source or the quality of the eggs. An odd number of eggs was regarded as favourable and the number of eggs in 80% of the sets was odd. The mean size of a set was 9.4 ± 3.0 ($n = 66$).

Hatching of eggs

The mean hatching rate was $67.0 \pm 32\%$ ($n = 66$). The hatchability was not affected by the season, or by the number of eggs in the set. Broody hens were sometimes lent to neighbours to incubate and to raise the brood. The mean weight of the chicks at hatching was 27 g.

Raising of chicks

The hens stayed with the brood for up to three months, by which time the young growers had separated themselves. The growth rate was very variable, body weights ranging from 41 to 100 g at 20 days, and at 70 days 142 to 492 g, with a mean of 313 ± 163 g. The mortality rate was high with some 65% dead within 70 days (Fig. 1). Losses were attributed to predators. There was no correlation between brood size, season of hatching and survival to eight weeks.

Egg laying

The mean age at first lay was 211 ± 36 days ($n = 50$). When the pullets weighed 1160 ± 227 g ($n = 28$). The mean weight

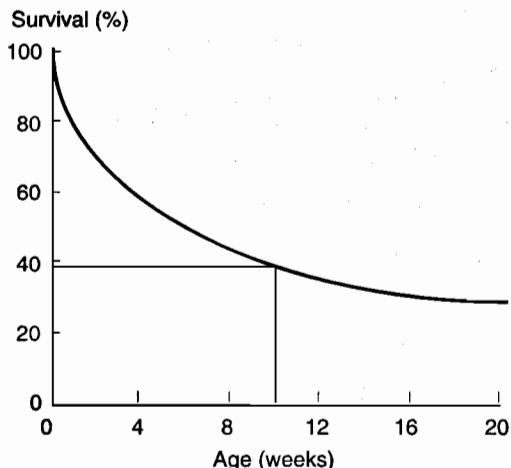


Fig. 1. Survival of chicks in scavenging flocks

of laying hens was 1259 ± 209 g. Mature cocks weighed 1778 ± 310 g. The laying pattern was variable, some birds laying every other day, others laying for two or three days then resting for one or two days. The mean length of the laying period was 34 ± 13 days, and the batch size was about 20 eggs. The mean egg weight was 48 ± 3 g ($n = 76$). If the hen was not given a set of eggs to incubate, she resumed laying after about three weeks. If she was incubating eggs, then there were three weeks incubating, up to twelve weeks with the chicks, then a further two weeks before laying recommenced. Some eggs were laid away from the homestead and were lost to neighbours or predators. The hen day production for all birds was 30% and, on a monthly basis, did not vary significantly during the 12 months of the study. The hen day production for the different flocks ranged from 11 to 57%. There were no significant relationships between hen day production percentage and family size or flock size.

Activities of hens

The only times that hens rested during the day were around noon on cloudless days and during heavy rain, when they

sheltered under trees. Three of the 15 hens whose activities were recorded laid eggs, all in mid morning. Twelve of the 16 mated and those which did mate did so an average of four times in the day. Sixty-four percent of the matings took place in the morning. There was no relationship between mating and the presence of an active ovary. More than 90% of the day was spent in scavenging — walking, scratching, leaf turning and pecking. Cattle and goat pen areas were favoured scavenging areas. All hen activities were individual, birds being together only when feeding on household waste, in the early morning and evening, and when mating. They drank an average of 3.3 ± 2.2 times a day.

Household refuse

The quantity of household refuse accumulated in a day averaged 460 ± 210 g from 14 collections. Thirty-six percent of the refuse was cooked rice, 30% coconut residue, 8% broken rice and 26% sundry (vegetable trimmings, bread, dried fish and scraps). The compositions of the major components and of pooled refuse are presented in Table 1.

The feed intake

More than 70% of the crop contents, averaged over 15 hens, was household refuse, being cooked rice (28%), coconut residue (16%), vegetable waste (9%), broken rice (4%) and sundry household materials (15% bread, egg shell, cooking waste and dried fish). The contribution from the environment was mainly grass shoots (13%), 8% small metazoans (earth worms, snails, ants and flies), and paddy rice (7%) a proportion of which would have come from the household refuse. The mean composition of the contents of crops is set out in Table 1. The gizzard contained large amounts of insoluble grits. Most birds had a substantial accumulation of yellow abdominal fat and a moderate layer of yellow subcutaneous fat.

The apportionment of output

The egg consumption averaged 4.1/person/month, ranging

Table 1. The average compositions of the major feed components, and of the feed intake, of scavenging hens

Component	Dry matter %	Crude protein %	Ether extract %	Crude fibre %	Ash %	Ca (mg/g)	P (mg/g)
Household refuse	43.2	10.3	7.2	2.2	1.4	0.8	4.0
Cooked rice	30.0	6.5	1.0	0.6	1.0	0.3	1.3
Coconut residue	24.1	6.9	38.1	8.9	1.1	1.1	6.0
Broken rice	85.9	9.0	1.3	1.5	3.2	0.5	1.4
Crop content	34.4	9.4	9.2	5.4	16.0	0.8 ^a	0.9

^a Does not include one value of 27 mg/g from a crop containing a snail.

from 0.7 to 14 between the households, being 71% of total egg production. All but one family sold some eggs, the average annual income from eggs being Rs. 250±264, with a range from – to Rs. 1075. Sixty-one percent of families sold birds, yielding average income from sale of birds of Rs. 224±400, ranging up to Rs. 1905. The total annual income from the flocks averaged Rs. 475 ±530, ranging from 0 to Rs. 2399. The daily wage for a casual labourer is approximately Rs. 55 (US\$2 = 43 SL Rupees).

Plasma measurements

Calcium in plasma was 11.0±3.2 mg/100 ml, including a value of 18.9 in a hen with an egg undergoing shell deposition in the oviduct. Phosphorus levels averaged 2.5±0.5 mg/100 ml.

Discussion

The production data observed were similar to those recorded for scavenging chickens in other studies. The data from Thailand (Janviriyasopak et al 1989) may reflect the emphasis on meat production, the flock size (30) being larger than that of the present study, the growth rate of chicks slightly higher (4.2 g/day), the mortality rate (30% to 12 weeks) much lower and the egg production (15% hen day production) about half. The consumption of birds was much higher at 13/flock/year. In Indonesia (Kingston 1980; Kingston and Cresswell 1982), the mortality rate of chicks (69% to 6 weeks) was even higher than in the present study, growth rate was slightly better and egg production was lower (20% hen day production).

The per capita consumption of eggs in Sri Lanka is 4 eggs/month (Food Balance Sheet 1989) and half the participating families have not reached that level. If they had consumed all of the eggs produced by their chickens, all but three families would have reached the national per capita consumption level. Nevertheless, the small cash flow generated by the sale of eggs may be more important than the eggs. The average incomes from the sale of eggs and birds are about equal, but that from eggs is more evenly distributed among the families.

The scavenging village chicken has cultural, social, nutritional, economic and sanitary functions in the life of the community. The feed resource base for the chickens in the traditional husbandry system described has no alternative use and, if village chickens were not present, other scavengers, particularly dogs and crows, would have performed that function with no associated productivity.

No inputs of significance were provided to the flocks described, and as subsistence farmers are unable or unwilling to pay for inputs it may be possible to increase productivity by more efficient use of the existing factors

of production. The householders are reluctant to part with their hens, so one cause of low productivity could be the lower egg-laying capacity of older hens. More frequent turnovers of hens might also improve income if that is important, and some flocks might be more efficiently utilised for meat production for the festive season market, rather than their existing low efficiency egg production. The mortality rate of 65% in the rearing of young chicks represented eggs hatched which could have been sold or eaten, and laying time lost while the hen incubated the eggs and reared the batch of chicks. Further, only a fraction of the feed consumed by the chicks which died returned to the scavenging pool. Although predators were blamed for the losses, the very wide range of growth rates for chicks, and the low protein diet, probably mean that malnutrition and associated weakness are major causes of losses, both directly and, by increasing vulnerability to predation, indirectly. If the young chicks were given preferential access to the household waste by using a simple creep feeder made from local materials, then a substantial proportion of the wastage might be averted. The mortality rate of young chicks was steady (Fig. 1) and there was no evidence of a disease outbreak in any age group, so disease is unlikely to have been a primary cause of the high mortality rate. No analysis of the causes of the wide range of hen day productivities was possible, but one likely cause is hens laying away from the nest because of inadequate provision of nesting space, or bad habits. Further, as the chickens are fed around 0800 h and the hens lay around mid morning, there could be an advantage in providing laying nests in the night pen, feeding the hens with the household waste in the pen, and then releasing them after laying time. The inputs required to implement any of the above measures are information and a little labour. As nearly all heads of households were literate, the former can be provided and the latter is not particularly demanding.

The study was designed to interfere as little as possible with the existing husbandry system. No birds were vaccinated for Newcastle disease (ND), which can cause mortalities approaching 100% (Fonseka 1987). As all of the chickens were penned every night they could be controlled for an organised vaccination program. With the threat of ND removed, consideration could be given to increasing productivity by providing supplementary inputs. The analysis of crop contents is similar to that quoted by Prawirokusumo (1988), but the higher ether extract and lower crude fibre in the present study allows more scope in the choice of supplements. The proximate analysis of feed and crop content, and the presence of substantial abdominal fat in all hens, indicates that the availability of protein was a constraint on production. Protein to supplement the diet is available in local by-products including fish meal, coconut oil meal and rice bran. The moderate level of fibre in the crop content (5.4%) would also allow supplementation with high fibre protein

supplement such as coconut oil meal. The levels of Ca and P in the diet were very low, as were the levels in plasma, compared with those of birds in intensive production systems (S.P. Gunaratne and A.D.N. Chandrasiri, pers. comm.). Calcium and phosphorus could be easily and cheaply provided in the form of shell grit and bone meal. Supplementation of deficient nutrients in the feed resource base would inevitably increase the production and the net output.

This study is location specific, for other locations would have different access to the by-products of cultivation and harvest, perhaps a more distinct seasonal availability of feed in the environment, a different domestic diet, and a different density of housing, among other factors. Nevertheless, some of the same simple principles can be applied in any environment to provide the information needed as a basis for increasing the welfare of the village families which keep scavenging chickens. The aggregate information could then be used to develop recommendations for improving the productivity of scavenging chickens in any particular cultural environment. Benefits from scavenging village chickens accrue to those in the community who have the greatest need and would be multiplied enormously over the poultry flocks of the developing world. Perhaps the first step would be to reduce the information void, and make poultry owners aware that there are options, and that it is possible to increase the benefits from their chickens without necessarily incurring additional costs.

Acknowledgment

The support of the Director of the Veterinary Research Institute, Dr M.C.L. de Alwis, is appreciated. We are grateful to the farmer families for their cooperation. The study is funded by the Australian Centre for International Agricultural Research.

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The Role of Village Chickens in the Poultry Industry in Sri Lanka

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Abstract

Up to the 1950s all eggs produced in Sri Lanka were derived from indigenous village chickens. Eggs were also imported from India. In the mid 1950s, male birds from improved breeds were issued to farmers in order to improve the performance of their offspring. The deep litter system was also introduced and popularised in the late 1950s. Devastating epidemics of Newcastle disease which discouraged most farmers from engaging in large scale poultry breeding were controlled by the introduction of vaccination.

The commercial poultry sector grew in the 1960s. There are 14 private and 3 state farms importing parent stock, and producing commercial hybrids locally. At present, of a poultry population of 9 million, about 75% are reared under intensive conditions, and the balance (25%) are what may be described as village chickens. This segment of the poultry population contributes approximately 15% towards the island's egg production. It consists of different grades of management systems ranging from absolute free range (scavenging all day, fed only household refuse), to semi-intensive (housed for part of day, and supplementary feeding). The type of bird also is variable, ranging from indigenous birds to improved crosses.

The egg is recognised as the cheapest source of animal protein in the diet of Sri Lankans. The price escalation of eggs and chicken meat, relative to other animal protein sources have been relatively low, during the past decade, and poultry meat now ranks relatively low in price. Of all the animal industries, the poultry industry has shown the highest rate of development during the past few decades.

SRI Lanka is an island nation of population 17 million and area 66 000 km². The estimated poultry population in 1991 is 9 million, approximately 25% of which can be categorised as village chickens. These are estimated to contribute approximately 15% of the total egg production in the country. For comparison, populations of other livestock species are: 1.8 million cattle; 0.96 million buffaloes; 0.5 million goats; 29 000 sheep; and 86 000 pigs.

Historical

Up to the 1950s, all eggs produced in Sri Lanka came from indigenous village chickens, each bird producing 40–60 eggs per year. The cost of production was practically nil, since these birds scavenged for their food, with some supplementation by household kitchen refuse. Minimal housing was provided at night, for protection from predators, and an enclosure of some type for part of the day to facilitate egg collection.

The rest of the eggs consumed in Sri Lanka at that time were imported from India.

In 1955, the Government of Sri Lanka began to expand and improve the poultry industry. Initially, males from improved breeds were distributed to farmers. This doubled the egg production in the subsequent generation. The deep-litter system of intensive management was introduced and popularised in the mid 1950s. One of the reasons why farmers were reluctant to take to large-scale poultry farming was the heavy losses caused by devastating epidemics of Newcastle disease (ND). Vaccination against ND began in 1951, but became popular, and more effective, with the introduction of the lyophilised vaccine in 1960. During the period 1955 to 1964, poultry production increased by 85%, and it was possible to discontinue the import of eggs from India in 1963.

During this period, a group of large-scale poultry breeders emerged. Initially, they imported commercial day-old layer chicks. Later in the 1960s, they started importing parent stock, and produced commercial layer chicks locally.

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The Commercial Poultry Sector

The commercial poultry sector has grown rapidly since the 1960s, substantially boosting the poultry industry. At present, there are 14 private and 3 State farms importing parent stock, and the island's incubator capacity is estimated at 2 million eggs per setting. The sector has imported parent stock from highly reputed sources of proven high performance in their countries of origin. It is noted, however, that their performance under local management conditions has been variable, and this is attributed to the genotype x environmental interaction, as these birds have been reared and selected under high resource consuming environmental conditions in their countries of origin, which most local farmers are unable to provide.

In one State farm alone, a breeding program has been carried out with the objective of producing a commercial layer adapted to local environmental and management conditions.

The broiler industry in Sri Lanka was introduced in the 1970s and grew markedly in the 1980s. The output of broiler chicks rose from 40 000 per week in 1980 to 280 000 per week in 1990.

The Role of the Egg in Human Nutrition

Protein malnutrition is a common feature among the low income earning rural and urban Sri Lankan population. The egg has many advantages over other sources of animal protein in bridging this gap. Apart from its high biological value and the absence of storage problems (unlike meat, fish, etc.), it is also the cheapest source of animal protein. The costs per gram of protein from various sources shown in Table 1 illustrate this point.

Table 1. Cost per gram (in Sri Lanka rupees) of pure protein from different sources in Sri Lanka

Protein source	Cost per g of protein
Eggs	0.33
Fresh cow's milk	0.30
Beef (moderate fat)	0.48
Chicken	0.57
Pork (lean)	0.57
Pork (moderate fat)	0.80
Fish	0.80

When one considers the increase in market price of various animal protein sources in Sri Lanka during the period 1982-89 (Table 2), it is evident that the cost of egg protein has increased by less than most other sources of animal protein.

Table 2. Increase in price of animal protein from various sources in Sri Lanka over the period 1982-89

Protein source	Increase in price (%)
Eggs	166
Beef	240
Mutton	239
Pork	197
Chicken	176
Fish (fresh)	193-254 ^a
Fish (dried)	137-213 ^a
Milk (fresh)	213
Pulses	151-194 ^a

^a Depending on the variety

Consumption of Poultry Products

The consumption of poultry meat and eggs in Sri Lanka is low compared with the developed countries, and even some developing countries. Nevertheless, the annual per capita consumption of poultry meat and eggs has increased from 100 g and 20 eggs in 1980 to 1 kg and 47 eggs in 1990. This increase in per capita consumption, despite the population growth over the same period, gives an index of the development of the industry. The average figure of 47 eggs is derived from a narrow segment of the 'elite' urban population, who consume around 150-200 eggs per year, and the vast majority of the rural population whose consumption is extremely low.

Consumer Preferences

The busy urban housewife, who has little time to devote to food preparation as part of her daily routine, prefers a soft broiler chicken to a village chicken. In rural areas, however, the village chicken is preferred for traditional preparations and therefore fetches a higher market price. Overall, there is a preference among Sri Lankans for the meat and eggs of free-range village chickens.

Poultry Production Systems

Over 50% of the poultry population of Sri Lanka is concentrated in the western coastal belt, approximately 50 km south, 80 km north and 15-20 km inland of the capital, Colombo. This distribution pattern is influenced by several factors. These are: (1) the proximity to potential markets in the urban and suburban areas around Colombo, and a large number of tourist hotels; (2) proximity to the feed manufacturing industry; and (3) the relative absence of religious prejudices among the population in this area.

The different poultry production systems prevalent in the country, and the types of birds and management systems involved, are shown in Tables 3 and 4. What may be described as 'village chickens' fall into the 'semi-

intensive' and the free range or 'backyard' categories. This group accounts for approximately 25% of the poultry population and contributes approximately 15% of the national egg production. While all production systems are found throughout the island, there is a concentration of larger holdings in the western coastal belt.

Table 3. Characteristics of poultry production systems in Sri Lanka

Production system	No. of birds/holding	Source of replacement chicks
1. Intensive Large scale	> 5000	Private breeder Imported parents
Medium scale	1000-5000	"
Small scale	100-1000	" or locally bred hybrid
2. Semi-intensive	50-100	Locally bred hybrids
3. Free range	10-50	Self sustaining

The intensive large-scale poultry farmers (> 5000 birds) are quite independent, and have adequate resources to look after themselves. To a lesser extent, this is true of the medium-scale category (1000-5000 birds). Government efforts through the Department of Animal Production and Health are directed towards two objectives: (1) To develop and improve the intensive small-scale poultry farmer, with a view to moving towards the goal of self employment. Many of those who have taken to poultry farming under the Government's Poverty Alleviation Program fall into this category. (2) To improve the status of the semi-intensive poultry farmer, with a view to elevating him to the intensive small-scale category. This is particularly important in the urban areas, where land for free-range or semi-intensive management is limited. A noteworthy finding of many surveys has been that, while the consumption of poultry products in general, and eggs in particular, is low among the rural sector of the population, it is above the national average among those persons in the rural sector who raise poultry in their own houses. Thus, encouraging small-scale poultry raising at home also means encouraging higher consumption of poultry products, thereby elevating the nutritional status of the rural population.

Table 4. Inputs to the various types of poultry production systems in Sri Lanka

Production system	Feeding	Management	Inputs
Intensive Large > 5000	Produced in farm or custom mixed	Hired management and labour	1. Staff + 2. Labour + 3. Feed + 4. Day-old chicks + 5. Maintenance+
Intensive Medium 1000-5000	Purchased	Owner managed Hired Labour	1. - 2. Labour + 3. Feed + 4. Day-old chicks + 5. Maintenance+
Intensive Small 100-1000	Purchased	Owner/family	1. - 2. - 3. Feed + 4. Day-old chicks + 5. Minimal
Semi-intensive 50-100	Purchased + scavenging	Owner/family	1. - 2. - 3. 50% feed 4. Day-old chicks 5. -
Free Range 10-50	Scavenging	Owner/family	1. - 2. - 3. - 4. - 5. -

Poultry Feed

In the commercial poultry sector, feed accounts for 70–90% of the cost of production. With the growth of the industry from 1980 to 1990, there has been an eight-fold increase in the demand for broiler feed, and a two-fold increase in the demand for layer feed. Imported strains of birds in the commercial sector are highly sensitive to quality of feed and, for the maintenance of high production levels, feed quality is of paramount importance. To supplement what is locally available, feed ingredients are imported and, as a result, there is a drain on valuable foreign exchange. The type of bird the local breeding program is seeking to develop is one that is less sensitive to feed quality, and could produce reasonably well on poor quality feeds, and poorer management conditions in the hands of the small-scale farmers. The semi-intensive sector is relatively less dependent on the feed industry, while free-range birds are totally independent.

Research on the 'Village Chicken'

Until recently, little or no work was done on village chickens. Epidemics of ND have been a major problem in this segment of the poultry population. Among the free-range birds, vaccination coverage is estimated at only 20%. These birds may also be considered to be a reservoir of infection. Attention was focussed on the health of village chickens during field trials with the oral feed-delivered V4ND vaccine. It is intended to investigate other causes of mortality in the near future.

Attention has also been drawn to production parameters for, and nutritional status of village chickens, and investigations are currently in progress. The overall objective is to improve the productivity of this sector, with minimal additional inputs.

The Poultry Industry in Lesotho

Lebohang Khomari*

Abstract

Rural chickens have been reared in Lesotho for centuries. Since the introduction of commercial poultry in 1972, the rural industry has been neglected. There are modestly sized layer and broiler industries, based on chickens imported from the Republic of South Africa. Newcastle disease (ND) is the major infectious disease, introduced with the commercial chickens. There is a small local capacity for the production of vaccines.

Rural chickens are now reared in the less accessible rural areas. There have been recent attempts to improve the productivity of these chickens in some areas by cross breeding with imported Plymouth Rock stocks. ND vaccines are not used in the rural chickens except at the request of owners.

Basotho people have been keeping village poultry for centuries. Indigenous chickens are normally reared under very inexpensive management systems. They are provided only with night shelter including nests for laying and brooding for hens. The rest of the chickens find a sleeping place anywhere near the house. During the day the chickens are left to roam and scavenge. Normally the chickens are fed on household refuse or maize when available, which could be twice or three times a day depending on the number of meals a family has, but no water is ever provided for them.

Commercial poultry rearing started only in 1972. The most prominent component of this modest industry is layer rearing, which amounts to a population of 22000. This is supported by a very good market outlet for the sale of eggs and also by protective legislation that inhibits the importation of eggs. Eggs can be imported by the Egg Circle (Board) only during times of egg deficits. Some 239 million eggs were imported in 1990.

The broiler industry is still small, despite the fact that 103.86 million carcasses of poultry meat were imported in 1990. The broiler population is about 1 million. The reasons for this situation are lack of established market outlets, precarious supply of day-old chicks and stiff competition from the Republic of South Africa (RSA). All commercial chickens are imported from the RSA, which means their supply to the domestic broiler industry can never be guaranteed and as a result, neither can

supplies to commercial outlets such as supermarkets. Supermarkets need not only guaranteed supplies but also properly dressed chickens that have undergone some inspection in a recognised poultry slaughterhouse. There is no embargo on poultry meat coming from RSA, as Lesotho belongs to the common customs union. This is an unfortunate situation, as our commercial farmers are subjected to unfair competition. Our farmers import day-old chicks, feedstuff and veterinary drugs from RSA, which increases their costs and consequently the cost of production is high. The commercial poultry industry has undoubtedly raised the standard of living of our community and has created jobs for many women, who make up 99% of the poultry farmers.

Realising that poultry keeping is an important contribution to the livelihood of the Basotho nation, the government sought to assist in reducing losses due to disease. A study of the status of poultry diseases was conducted, and it was established that Newcastle disease (ND) was the number one killer disease in chickens. It was also determined that the ND vaccine that was then imported was not readily available and was very costly. For these reasons, the Livestock Department requested that a small vaccine production unit be established specifically to produce ND vaccine.

Local production of ND vaccine began in 1984. The vaccine was then sold to the farmers for half the cost of the imported vaccine; currently, it is about two-thirds the cost. A cost analysis of production as compared with importation has not been undertaken. Only the La Sota

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strain is used. It is cultured in specific pathogen-free eggs that are also imported from the RSA.

Since all commercial chickens are imported, first vaccinations are done in their country of origin. Initially, after their arrival in Lesotho layers were vaccinated with La Sota vaccine at intervals of 3 months. Broilers were vaccinated at 9–10 days of age. With the introduction of oil-based ND vaccine, layers are now not revaccinated throughout the laying period unless there is an outbreak. Broilers are also not vaccinated unless there is an outbreak or they are raised in areas where there seem to be regular outbreaks. In these instances, broilers are vaccinated at day 9.

Newcastle Disease

ND was first recorded in Lesotho in 1972 following the introduction of hybrid chickens. This resulted in outbreaks of ND in indigenous chickens. Campaigns to treat all poultry with Komarov vaccine were then adopted as a policy. Strict precautions were taken, and farmers were not allowed to keep both exotic and indigenous chickens close together. Consequently, the incidence of ND declined. As the industry grew bigger, and strict and regular vaccinations of commercial chickens were instituted, vaccination of the indigenous chickens stopped. It is now done only at the request of owners.

No outbreaks of ND had been reported for a decade in indigenous chickens until this year, 1991. In August 1991, an outbreak involving both exotic and indigenous chickens was reported. This occurred in a very small area.

Rural Poultry

There are 1.6 million rural chickens. Most of them are concentrated in areas inaccessible by road. People in accessible rural areas are rearing commercial chickens.

Attempts to improve indigenous chickens to meet the increasing nutritional demands of the rural people started only this year with the introduction of Plymouth Rock cockerels and hens. Statistics on their performance are still incomplete.

Their introduction was initiated by the farmers, some

of whom were keeping commercial chickens and were experiencing immense problems with unavailability of day-old chicks, and constant increases in the cost of feedstuff and veterinary drugs.

When the Plymouth Rock was introduced, some farmers tried to rear them under management systems similar to those used for commercial hybrid chickens. Their performance was poor, compared with those that were left to roam and scavenge. Their progeny have better body mass than indigenous chickens and they are resistant to diseases. During the outbreak that occurred in 1991, the Plymouth Rock indigenous chickens were not affected, even though the outbreak occurred in the area where the Plymouth Rock project is under way. Most likely this was due to passive immunity.

The Plymouth Rock cockerels and hens are vaccinated at 1 day old and at 4 weeks, after which they are distributed to the farmers to introduce them to their indigenous chickens. Their progeny are not being vaccinated. Very few diseases are encountered in indigenous chickens. These are internal and external parasites, and sporadic outbreak of fowlpox.

Conclusion

Commercial chicken production generates attractive income returns and the Livestock Department of Lesotho has favoured this enterprise over rural chicken production. However, this restricts improvements in standard of living to people who can raise security for bank loans to pay for commercial chickens, their highly priced food and the numerous veterinary products that are required to control their diseases. The less privileged members of society receive no benefits from the commercial industry. The introduction of the Plymouth Rock represents an attempt to improve utilisation of rural chickens so as to benefit the poorer people. For about 50% of the population, rural chickens supply the only source of animal protein, an ingredient that is lacking in most of the Basotho's diet. Commercial broilers of 7–8 weeks of age cost US\$4.5, while the GNP is US\$284. Indigenous chickens are preferred and fetch higher prices when they are available. Unfortunately, their population is low and this resource has yet to be properly exploited.

Epidemiology of Newcastle Disease and the Need to Vaccinate Local Chickens in Uganda

Mukiibi Muka George*

Abstract

Viscerotropic, velogenic strains of Newcastle disease virus are recognised as serious causes of mortality in village chickens in rural Uganda. The spread of Newcastle disease is generally attributed to the movement of infected chickens. A pilot vaccination study is being undertaken in three villages.

EPIDEMIOLOGY in our context embraces factors associated with production and transmission of Newcastle disease (ND) in the rural flocks. In Uganda, all farmers consider ND as a serious disincentive to investing in the chicken business.

The first documented evidence of ND in Uganda occurred in 1955 in and around Kampala, in the Central Region. There had been, however, earlier reports of a similar disease in the Eastern Region.

Elsewhere in Africa, cases had been reported in Kenya (Mombasa) 1935, Kenya (Nairobi) 1939, Sudan 1951, and Nigeria 1952. The first cases of ND worldwide were reported in England 1927, Java 1926 and Korea 1929.

This suggests that ND first appeared in Europe and Asia, then spread to Africa, probably through sea ports. It is also documented that the origin of the local (rural) chickens in the world was the 'jungles' of Asia.

The viscerotropic velogenic strains of ND virus are more common in the rural areas, sweeping through villages with mortalities approaching 100%. There could, however, be some less virulent strains in the rural areas that are either not easily recognised or given less attention.

In Uganda, the most virulent strain characterised so far was isolated by the author in 1986 in Entebbe. This virus produced 100% morbidity with 98% mortality. It had an ICPI of 1.75, IVPI 2.7 and MDT of 44 hours. Further characterisation by Alexander related it to PMV-1 with monoclonal binding pattern P.

The socio economic importance of ND in rural Uganda can easily be appreciated if one considers the role the rural chickens play there. Rural chickens require little attention,

feeding on leftovers and spending most of their time scavenging around the garden. This way they act as efficient waste-disposers, converting food leftovers into valuable animal protein. They do not require specialised housing and some roost outside on trees.

These rural chickens comprise 80% of the total poultry population of Uganda, which is about 20 million.

Almost every homestead has some chickens and they provide the cheapest source of animal protein in the form of eggs and meat. In addition, they are a ready source of income to help homesteads purchase basic requirements such as soap and paraffin, and may even help pay school fees in the rural primary schools.

The cost of a hen is 1500/-Uganda shillings (US\$1.50) which can buy a bar of soap, 1 kilogram of salt and one litre of paraffin. Similarly, two hens when sold would pay school fees for a term in the rural area. Culturally, at every function in Uganda there will be a chicken either slaughtered, exchanged or given away. Thus, if a homestead has had its flock destroyed by ND then it can be in a difficult position if a visitor arrives or a cultural function is held.

The seasonal occurrence of ND in Uganda is a well-established phenomenon among the rural farmers, so much so that, just before the dry season sets in, farmers panic and start selling off their stock. This usually triggers the spread of disease. The spread of ND in the rural areas may be abetted by both the management methods and cultural attitudes of the people. These birds roam in villages in search of food and this encourages the spread of disease. Birds given as gifts may be transported long distances on foot or bicycles. If there is an outbreak in one village, the disease is thus likely to spread widely due to human influence.

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In rural Uganda, ND occurs in waves which sweep through villages in the dry months of July/August and December/January. These hot seasons may be accompanied by high winds. During such periods there is less human activity in gardens, but more movement in the form of visits. The chicken is the smallest domesticated animal and is therefore used by parents to instill in children a love for animals. Because of this, whenever children visit relatives, they are initiated in animal husbandry by giving them a bird to take home.

In some areas in the Eastern Region, there is a barter system whereby for seven chickens one may be given a goat, and seven goats may be exchanged for a local cow.

The rural chickens are part of an integrated farming system where it is estimated that 15–20 chickens produce about 2 kg of chicken manure per day which is used as fertilizer in gardens. This is an input into the soils of organic fertilizers which encourages the development of earthworms on which birds feed. The soils also get aeration through worm burrowing. In addition to this, engorged ticks fall off cattle either in the evening or early morning, so the chickens are usually introduced in Kraals where they pick up these parasites.

While all these facts about the rural chicken and ND

are appreciated, little effort has been made to protect these birds in Uganda.

A pilot study was therefore undertaken to show the impact of ND vaccinations on the rural chickens.

An area distant from the large towns was selected to minimise the influence of exotic birds and in a place where the homesteads are representative of the rural people. Initially, three villages, namely Busesa, Ibalanku and Ibaako, were selected. Farmers were visited and the idea of protecting their flocks against ND was introduced by the local extension veterinary staff. Arrangements were made to provide free vaccine and basic cold chain facilities from the Vaccine Production Laboratories.

On set days, farmers were requested to keep their chickens indoors or tied up so that they could be vaccinated by the field veterinarian and his team of two poultry attendants. The route of administration of vaccine was the nostril/eye drop.

These vaccinations were first done in early May. In late May a booster dose was given and a census of chickens was undertaken in the participating homesteads.

In September, after the dry season, a census was again taken and farmers were asked general questions about their chicken flocks.

Table 1. Busesa village

Farmer no.	Total		Off Take and Loss May–Sept. 1991						Apparent total
	May 91	Sept.91	Disease	Predator	Sell	Goat barter	Slaughter	Other	
1	13	20	–	–	–	–	5	–	25
2	4	17	7	–	–	7 (1 goat)	–	–	31
3	10	20	1	1	–	–	–	–	22
4	29	34	–	8	–	–	2	3 (gift)	47
5	20	24	3	8	2	–	3	–	40
6	21	25	–	10	7	–	–	–	42
7	9	17	–	–	–	–	–	–	29
8	16	22	4	–	–	–	–	–	26
9	16	21	–	–	–	8 (1 goat)	–	–	29
10	2	9	–	2	–	–	–	–	11
11	8	17	–	3	–	–	–	–	20
12	12	9	–	4	–	–	–	–	12
13	22	18	–	7	–	12 (2 goats)	3	–	40
14	22	32	–	14	–	–	–	–	46
15	25	17	–	3	–	12 (2 goats)	–	–	34
16	25	48	3	–	2	–	–	4 (accident)	57
17	27	38	–	5	–	–	1	–	44
18	2	1	2	–	5	–	6	–	14
19	9	4	5	3	–	–	–	–	12
20	11	4	4	5	–	–	–	–	13
21	10	9	–	–	8	–	–	–	17
Totals	313	406	29	73	24	39	20	7	

Preliminary results are shown in Tables 1, 2 and 3 for the three villages involved. The counts were total, including all ages of chickens.

The impact of predators is shown to be high and, in the absence of ND, ranks highest as a problem for village

chickens. The economic importance of the village chickens is shown by a barter system in which some farmers obtained goats for their chickens. Cases of disease affect individuals rather than flocks, and were bacterial and parasitic in origin.

Table 2 Ibulanka village

Farmer no.	Total		Off Take and Loss May–Sept. 1991						Apparent total
	May 91	Sept.91	Disease	Predator	Sell	Goat barter	Slaughter	Other	
22	51	77	–	–	–	–	–	–	77
23	24	36	–	3	–	4	–	–	43
24	12	3	–	6	–	5	–	1	15
25	15	34	–	–	–	–	–	–	34
26	42	48	–	8	5	17 (3 goats)	4	3 (gift)	85
27	72	52	–	12	–	16 (2 goats)	3	–	83
28	2	11	–	–	–	–	–	–	11
Totals	218	261	0	24	5	42	7	4	

Table 3. Ibaako village

Farmer no.	Total		Off Take and Loss May–Sept. 1991						Apparent total
	May 91	Sept.91	Disease	Predator	Sell	Goat barter	Slaughter	Other	
29	10	23	–	4	–	–	3	–	30
30	18	16	8	4	–	–	–	–	28
31	10	18	–	–	–	–	–	9 (thefts)	25
32	8	8	–	4	–	5 (goat)	1	–	18
34	22	32	–	6	–	–	2	–	40
35	9	15	3	5	–	–	2	–	25
36	4	–	4	–	–	–	–	–	nil
37	22	32	–	10	–	–	5	2 (gift)	49
38	11	32	–	4	–	–	–	–	36
39	28	26	4	5	–	5 (goat)	6	–	46
40	6	37	–	–	–	–	–	–	37
41	17	10	6	4	–	–	–	–	20
42	40	46	5	7	8	–	3	–	69
43	8	23	–	–	10	–	–	–	33
44	12	18	–	–	–	8 (1 goat)	–	–	26
45	6	8	–	5	–	–	–	–	13
46	10	11	–	5	6	–	–	–	22
47	5	0	5	–	–	–	–	–	nil
48	2	19	–	3	–	–	–	–	22
49	17	16	–	1	3	7 (goat)	–	–	27
50	12	26	–	3	–	–	–	–	29
51	25	28	–	10	–	–	3	–	41
52	53	48	–	6	–	16 (2 goats)	1	–	71
53	20	32	–	3	–	–	–	–	55
Total	375	324	35	89	32	74	26	14	

From these figures, a growth of about 30% was achieved excluding the loss and offtake in a period of four months. This shows the high potential of village chickens.

As for Newcastle disease, it is too early to draw conclusions of the impact of these vaccinations since this will require almost 12 months of observation.

Village Chickens and Newcastle Disease in Nigeria

A.O. Olabode, A.G. Lamorde, N.N. Shidali, and A.A. Chukwuedo*

Abstract

Exotic and rural scavenger chickens are kept in both the rural and urban areas of Nigeria. Unlike the exotic birds, which number about 30 million, the local scavenger chickens numbering about 120 million are not routinely vaccinated against prevailing diseases. Prominent among these is Newcastle disease (ND). However, the exotic birds are protected with ND vaccines produced at the National Veterinary Research Institute, Vom. Recent investigations have indicated that the local poultry farmers would welcome ND vaccines capable of protecting the local chickens.

BOTH introduced chickens and rural scavenger chickens are kept in the urban and rural areas of the country. The exotic birds number 30 million while the rural scavenger chickens number 120 million (Yahaya, personal communication). About 85.5% of the rural scavenger chickens are found in the northern part of the country, the balance in the south. Kane State has the highest number (18.41%) in the north and Oyo State has 5.05% in the south.

Although little or no veterinary care is given to the rural poultry, they are present in greater numbers than the exotic breeds. They are found in villages and cities, and are kept by both the low and high income earning classes of people. They provide a cheap source of animal protein to the rural populace.

In Nigeria, a tentative diagnosis of Newcastle disease (ND) was made in April 1951, in two outbreaks on some poultry farms in eastern Nigeria (Kirby 1951). This was confirmed by laboratory tests at Vom. There were other outbreaks in parts of western Nigeria which were reported and confirmed (Hill et al, 1953). Other outbreaks of ND reported from eleven different parts of Nigeria indicated the extent of the disease. Some details of the incidence of ND and other poultry diseases in Nigeria are given in Table 1.

Currently, ND is viewed as one of the most serious fatal poultry diseases of economic importance in Nigeria among

the exotic and local chickens (Fatumbi and Adene 1979). Between 1981 and 1989 confirmed outbreaks of ND ranged from 11–82 (Annual Report, National Veterinary Research Institute, Vom, 1981–1989).

Vaccination

Since the first reported case of ND in Nigeria, the National Veterinary Services have adopted several prophylactic measures, the most significant of which is vaccination. ND vaccination was introduced into Nigeria even before the disease was recognised (Hill et al 1953). Following outbreaks of the disease in the Congo, the Komarov vaccine (Komarov and Goldsmith 1946) was imported from South Africa to protect the local flock and this was, for a long time, the only vaccine in use. Local production of the vaccine in Vom in 1953 was as a result of the difficulties encountered with the imported Komarov vaccine. This was due to the poor transport network between and within the country.

In an attempt to find a mild vaccine devoid of the disadvantages of the mesogenic strain, an intraocular vaccine strain obtained from Israel was introduced into Nigeria. This was followed in 1964 by the production of the La Sota vaccine, the seed virus of which was obtained from Holland. A comprehensive policy of immunisation was established using the three vaccines now produced at the National Veterinary Research Institute, Vom. These vaccines are used mainly for the exotic birds.

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Virulence

Velogenic strains of ND virus have mostly been found in the wild birds in Nigeria (Onunkwo and Momoh 1981; Omorodion and Olabode 1989; Adu 1987). However, lentogenic and mesogenic strains have also been documented. These birds serve as reservoirs and a source of dissemination of the virus to susceptible birds. More work needs to be carried out.

Acknowledgment

The author is grateful to Professor Spradbrow for nominating him for this conference and to ACIAR for supporting travel to Malaysia.

My institute seeks friendship, support and ideas. We hope that N.V.R.I. will be able to participate seriously in the network on this very important problem.

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Table 1. Poultry disease outbreaks in Nigeria. Comparing the situation in 1977-78 and in 1982.

Disease	1977-1978				1982			
	No. of outbreaks	No. of birds involved	No. dead (%)	% of total mortality	No. of outbreaks	No. of birds involved	No. dead (%)	% of total mortality
Newcastle disease	21	49391	26348 (52.7)	77.6	17	62621	27789 (28.3)	74.7
Gumboro disease	38	62123	7202 (11.5)	21.1	21	28488	4962 (17.4)	20.8
Fowlpox	19	5272 (4.8)	258	0.8	3	5700	37 (0.64)	0.20
Marek's disease	4	5900	130 (2.2)	0.4	-	-	-	-
Chronic respiratory disease (CRD)	-	-	-	-	2	2000	18	0.08
Fowl typhoid	-	-	-	-	5	9432	808 (8.6)	3.40
Coccidiosis	-	-	-	-	6	7000	128 (1.8)	0.54
Aspergillosis	-	-	-	-	1	10000	54 (5.4)	0.23
Avian leucosis	-	-	-	-	2	8500	17 (0.2)	0.07
Total	82	123226	33938	100	57	133743	23813	100

Source: Federal Livestock Department, Kaduna.

Village Chickens and Newcastle Disease in Bangladesh

Mohd. Asadullah*

Abstract

Newcastle disease is an important disease to the 80% of the population of Bangladesh who live in villages and raise chickens. The control of Newcastle disease depends on conventional vaccines and the provision of efficient cold chains.

EIGHTY percent of the people of Bangladesh live in villages. Most of the villagers like to raise chickens in their backyard. Chickens are generally kept as scavengers, and play an important role in the rural economy of Bangladesh. Villagers sell chickens and eggs in the village market to meet their income requirements. Nowadays, women and landless rural people are trying to acquire technology for small-scale poultry farming. Poultry farming has so far benefitted only higher income groups. Therefore, the Bangladesh Rural Advancement Committee (BRAC) has established a project in which landless women are provided with one cockerel and 10 chicks. Another non-government organisation (NGO) has come forward to train landless people and distressed women in the villages to raise chickens scientifically.

However, there are many constraints in the development of poultry farming and raising chickens in the villages, such as non-availability of balanced food, the occurrence of diseases, etc. The main diseases encountered are Newcastle disease (ND), fowlpox and fowl cholera. As well as diseases, heavy rains and sudden floods can destroy entire poultry populations in low lying areas.

Occurrence of Newcastle Disease

ND, which is popularly known in Bangladesh as Ranikhet disease, is endemic in this country and epidemics are reported throughout the year, with a peak during the months of November-February. A survey conducted by the Department of Microbiology and Hygiene of Bangladesh Agricultural University, Mymensing,

indicated that field infections are caused by velogenic strains.

Velogenic forms of the disease are characterised by very high mortalities, reaching 90% or more. The typical signs are increased respiratory rates, prolonged gasping, respiration with outstretched neck and head, partially opened beak, nasal discharge, profuse diarrhoea, temperature elevation by 1-2°C followed later by subnormal temperature, and nervous signs such as paralysis, tremors or torticollis. This is the usual form of the disease existing in Bangladesh.

Vaccines in Use

The selection of the type (live or inactivated) and the strain (lentogenic or mesogenic) of vaccine depends mostly on availability and the requirement of immunisation which, in turn, is determined on the basis of the type of field virus occurring in the region.

Considering all these points, the following types of vaccines have so far been developed in Bangladesh against ND:

1. Live lentogenic vaccine:- These are prepared with 'F' strain
2. Live mesogenic vaccine:- These are prepared with Mukteswar strain.

Current Control Program

The current program of vaccination against ND in Bangladesh includes eye drop administration of a live lentogenic vaccine of 'F' strain in baby chicks from

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day-old onwards to 7 days of age, followed by a live mesogenic vaccine of 'M' strain administered intramuscularly (I.M.) at 8 weeks of age, or in adult birds, and then usually at 6 month intervals.

In the case of broilers, the birds gain weight very quickly, and a single application of lentogenic vaccine during the first two weeks of life may not be sufficient considering the risk and the cost of such a flock. It is therefore necessary to revaccinate birds at 6-7 weeks of age with a mesogenic strain, particularly when disposal of birds is delayed.

Freeze dried vaccine of ND was introduced to Bangladesh in 1964, with the assistance of an FAO expert, Dr M.S.El. Sabban. Since then, this vaccine has been in routine use in the mass vaccination program of the Livestock Directorate. Its production is gradually being increased (Table 1).

All batches of vaccines are subjected to classical tests such as chick titration, safety testing and challenge. A virulent field virus is used in challenge testing. The requirement for all clean eggs and chicks for production of vaccine, chick embryo titration, chick titration, and safety testing are met by the Central Government poultry farm.

With the help of the Asian Development Bank (ADB), the Directorate of Livestock Services, Bangladesh, has established cold rooms in every district. A cold chain is maintained to supply vaccine to district cold rooms, and freezers are used to carry vaccines to the most remote parts of the country.

To control ND in Bangladesh, mass vaccination efforts are being strengthened every year, particularly through

Table 1. Production and distribution of Newcastle disease vaccine (million doses) in Bangladesh during the years 1986-1991.

Year	Newcastle disease vaccine for adults (M.strain)		Newcastle disease vaccine for chicks (F strain)	
	Production	Distribution	Production	Distribution
1986-87	58.29	64.29	26.54	25.99
1987-88	106.97	77.39	35.13	29.10
1988-89	99.57	104.27	44.53	45.01
1989-90	125.67	116.21	43.26	43.36
1990-91	134.37	128.03	55.37	55.59
Total	524.87	490.19	204.83	204.05

the help of non-government organisations. For example, BRAC (Bangladesh Rural Advancement Committee) is training unemployed people to become poultry workers. The training includes preventive and curative aspects, along with rearing management. The vaccines are distributed to them by BRAC, free of cost, from government stocks. They are regularly supervised at village level. The poultry workers or vaccinators of both government and NGOs are provided with thermos flasks to maintain the cold chain; other inputs provided include a carrying bag and a glass syringe.

Given the efforts described in this paper, it is expected that ND will be totally controlled in Bangladesh in the near future.

Present Status of Poultry in Nepal

Upendra Mishra*

Abstract

Nepal, a Himalayan Kingdom with diverse climatic zones, has a long history of traditional poultry keeping. Improved breeding commenced in 1953.

Poultry are a valuable source of dietary protein and rural cash income. The country has commercial, smallholder and backyard types of farms, with a total population of 12 million birds, including ducks. Some 92 000 t of poultry meat and 35.5 million eggs were produced during 1990, contributing 1.6% of Agricultural GDP.

Ninety percent of poultry are raised as free-ranging birds with no significant investment from villagers. Village chickens called 'Shankini' are slow growing and susceptible to disease. Most poultry diseases are present in the country, but Newcastle disease (ND) in particular causes great economic losses, estimated at NRs. 74.77 million in 1990.

Movements of poultry increase during the hatching and festival seasons. The country is self reliant in feed products, but improved genetic materials are imported.

The Department of Livestock Services and the Nepal Agricultural Research Council are the agencies responsible for disease diagnosis, research, vaccine production and control activities, with a network of different units throughout the country. Strict legislation to control disease is lacking.

ND is common throughout the country, with higher incidence of outbreaks in summer. Current locally manufactured vaccines (F₁ and R₂B) have limitations and are used in only 10% of birds. Outbreaks still occur in vaccinated flocks.

The food pellet NDV4 strain vaccine is under trial at Pakhribas Agricultural Centre. Results have been encouraging, but further trials are needed in different agro-ecological zones of Nepal.

NEPAL is a developing, land-locked, agrobased country, situated in the mid Himalayan zone, with a land area of 147 181 sq.km, and ranging in altitude between 300 and 8000 m. Altitude and topographical differences result in varied climates. Nepal has three main ecological belts viz. Terai 17% (300–1000 m altitude), Hill 68% (1000–3000 m) and mountain 15% (3000–8000 m) with a population more than 19 million. The average population density is 129 persons/sq.km.

Nepal has the highest animal population density in the world (36 per sq.km.) with an average livestock holding of 2.09 per house. The roles of livestock in socio economic development and as a source of supplementary cash income, self employment, livelihood and existence are

crucial, contributing 18.2% of the agricultural gross domestic product (AGDP), which accounts for 58.2% of the total GDP of Nepal.

Poultry Production

Nepal has a long history of poultry keeping. Improved poultry keeping commenced in 1953. In 1959, 1700 improved birds (200 cocks and 1500 hens) were brought from New Jersey, USA, for cross breeding purposes. Today, most of the popular poultry breeds are imported from abroad.

Poultry form a valuable source of protein in the diet and of rural cash income, as well as a source of manure to the average farmer. Village free-range poultry still play a dominant role in meat and egg production. About 90% of the birds are raised in the rural countryside with no

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Status of Newcastle Disease

Past record of Newcastle disease

Clinical, pathological and serological studies have revealed the presence of ND in Nepal from early times. It is universally accepted by all those connected with the poultry industry that it is constantly present and widespread in distribution, affecting all poultry.

Present ND situation

As already noted, ND causes large economic losses in Nepal due to mortality and morbidity (meat & egg production). It affects all age groups of chickens.

Only commercial poultry units, which constitute 10% of the total poultry population, have been taking advantage of the current vaccination program in easily accessible urban areas. The existing type of ND vaccine has limitations for use in rural conditions, and has, as well, led to several cases of post-vaccination reaction and reoccurrence of the disease in vaccinated flocks.

The disease affects mainly domestic fowls. Ducks and geese develop a symptomless infection with production of antibodies. Various wild bird species are also affected during outbreaks.

Resources Available for Newcastle Disease Control

Agencies involved in ND control

The Department of Livestock Services and some private hatcheries are involved in the control of ND in Nepal. Lentogenic strain F₁ and mesogenic strain R₂B vaccines are produced locally and distributed throughout the country by different veterinary hospitals. Some private farms also procure ND vaccine from other countries.

Organisation of veterinary services

Nepal has a network of Livestock Service Sections (75), checkposts (24), dispensaries (4), Livestock Service Centres (749), Regional Laboratory (2) and Central Level Units (5) under the DLS & NARC's CADRD, PAC and LAC (see Fig. 1)

Diagnostic facilities

Diagnostic facilities are available only at the Central Animal Disease Research Division (CADRD), and at Tripureswor and Pakhribash Agricultural Centres of the Nepal Agricultural Research Council (NARC). Both microbiological and serological facilities are available inside the country. Antigens and hyperimmune serums are obtained from India. Procurement of enzyme

significant investment in feeding and housing. The rural poultry survive on grass seeds, grass tops, grain residues, insects and kitchen wastes. Nepal is self reliant in poultry feed production, and has commercial, small holder and backyard types of farms for meat and egg production. About 92 000 t of poultry meat and 35.5 million eggs are produced each year.

Explosive growth of population and increasing tourism has accelerated demand for poultry meat and eggs. Poultry meat currently costs around 70 N rupees/kg and eggs around 2.5 N rupees each.

Poultry disease situation and control measures

Village chickens called 'Shankini' are slow-growing and present problems in disease control. Most of the well-known poultry diseases occur in Nepal. Of the viral diseases, Newcastle disease (ND) is a major cause of high mortality (90%). It occurs throughout the country, with highest incidence in summer. Almost all pathotypes of ND virus are present in the country. Outbreaks in vaccinated flocks are also noted. The disease causes great economic loss by mortality and morbidity, estimated at 75 million N rupees per year.

Present vaccines have limitations and are used in only 10% of poultry. Village chickens are left unvaccinated due to lack of trained technicians at farm level and the unavailability of vaccine.

Day-old birds are vaccinated with F₁ strain by the nasal or eye instillation method in the hatchery. In the few hatcheries where Marek's disease vaccine is administered, F₁ strain is given between 4 to 10 days of Marek's vaccination.

Poultry Movement and Trade Patterns

Commercial poultry birds, meat and eggs are generally transported to remote areas by aircraft, mule or porters, while in easily accessible areas they are moved by truck, bus, rickshaw, bicycle and porters. Movements of young chicks increase in the hatching season (September-March) and of other birds for meat and eggs during festival times, especially 'Dashera & Tihar' in the months of October and November.

Legislation for Disease Control

Legal provisions for the control of disease are made under the Infectious Disease Act 1963 but specific laws to cover, for example, quarantine, slaughter house management and meat inspection, and cruelty are lacking at present. A proposal for these acts has been submitted to the parliament.

substrates, monoclonal antibodies, SPF chicks and embryonated eggs, poses problems.

Epidemiological surveillance and reporting system

Epidemiological surveillance is carried out by CADRD and outbreaks of disease are generally reported by DLSS and private farmers directly to CADRD in the centre, PAC, LAC and regional laboratories. Samples are received from throughout the country for diagnosis. There is a well-developed communication network for notification of disease outbreaks.

Vaccine supply

The Biological Products Division (BPD) of DLS produces various vaccines which are distributed with minimal

charge through district livestock service sections (DLSS) and to private farmers throughout the country. Some hatcheries also procure poultry vaccine from abroad.

Vaccine storage and distribution facilities

All poultry vaccines are stored at -20°C centrally and in the freezing chambers of refrigerators at district level. Vaccines are distributed to the regions by refrigerated van, from where DLSS distribute them to farmers in thermos flasks packed in ice.

Control Policy

DLS of HMG/N has an ND control policy based on vaccination of poultry. There is no mass slaughter policy in the event of outbreaks. Hatchery owners and private

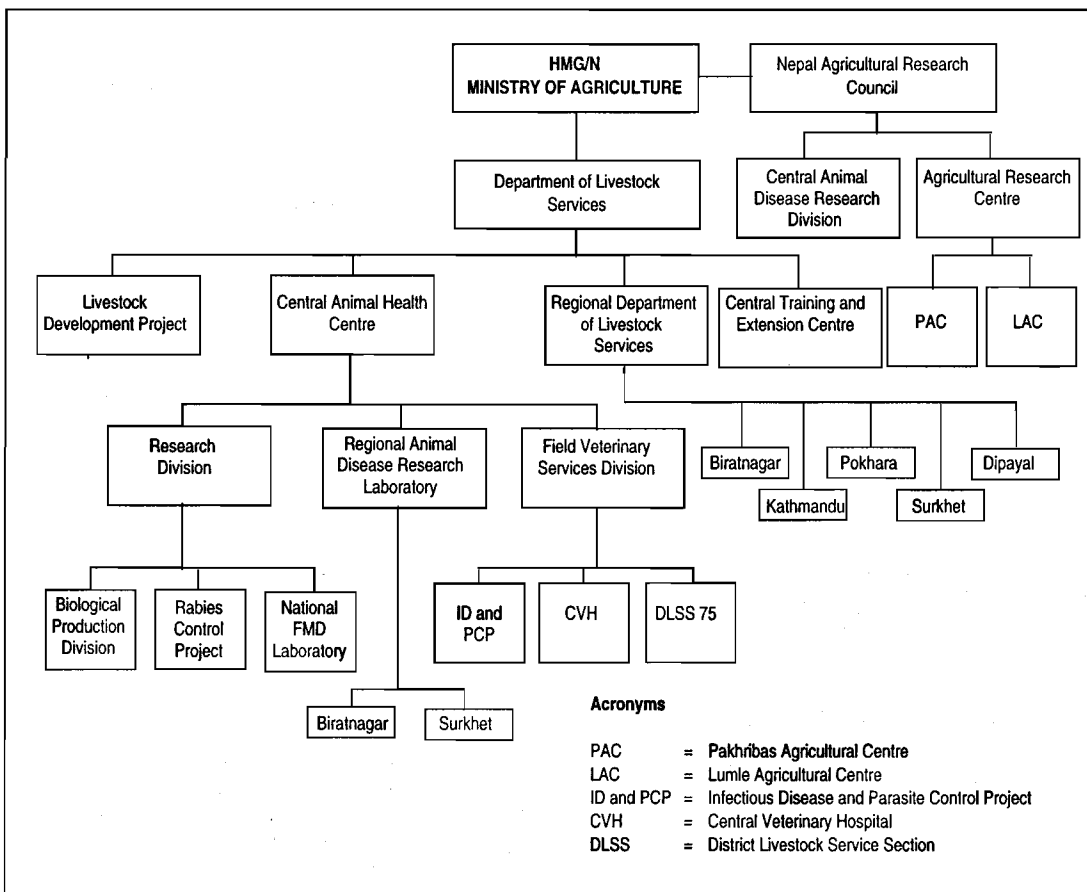


Fig. 1. Organisation of veterinary services in Nepal

farmers are not subsidised, thus they do not slaughter infected birds. Other hygienic measures are maintained by the owners themselves. There is no insurance system.

Research into Newcastle Disease Virus

Since the establishment of NARC, the CADRD has commenced epidemiological studies, virus isolation activities, sero-investigations, and studies of the efficacy of different types of vaccines available. Recently, food pellet NDV4 vaccine has been tested at PAC with encouraging results. Further trials are needed in different agro-ecological zones of Nepal.

Newcastle Disease in Myanmar

Kyaw Zaw Lwin*

Abstract

In Myanmar, 85% of poultry population occurs in villages and depends on indigenous breeds of chickens. Newcastle disease is a serious problem in these chickens. Vaccination against Newcastle disease is usually feasible only in commercial poultry operations. Simple, effective vaccines are required for village chickens. An efficacy trial of V4 food vaccine is being undertaken.

THE poultry population in Myanmar (Table 1) had been fairly constant for about a decade before declining sharply in 1988–89, owing to socio-political instability in the country. Since then, apart from the importation of a few batches of exotic breeds for state poultry farms, there have been few improvements to either commercial or small scale rural poultry farming. The 25 million chickens raised in 1990–91 produced an estimated 0.07 million tonnes of chicken meat, constituting 39% of total meat production. In Myanmar chicken meat is widely accepted by all national and religious groups, consumer preferences ranging from local, indigenous chickens to exotic broiler breeds. It is estimated that annual per capita consumption of chicken meat is 1.66 kg. Of total poultry production, 85% is derived from rural poultry farming, which is totally based on local indigenous chickens.

Unlike other livestock farming, a small flock of chickens can be raised by any household at village level. The average size of a rural poultry flock ranges from 5 to 50 birds, which are mainly kept as a source of additional income or for family consumption. Though each unit is small, for the whole country they add up to a population of birds larger than would be possible at commercial level.

At present, feed prices, like those of other commodities, are rising. Nevertheless commercial-scale intensive poultry farming remains profitable because poultry products are also increasing in price.

Poultry production in Myanmar has long been hampered by Newcastle disease (ND), the most

Table 1. Chicken population in Myanmar (yearly basis)

Year	Population ('000)
1981–82	27 234
1982–83	29 037
1983–84	31 001
1984–85	32 868
1985–86	32 681
1986–87	32 382
1987–88	33 519
1988–89	33 944
1989–90	24 195
1990–91	23 188

devastating poultry disease. Each and every year, most village chicken flocks are subject to severe losses caused by ND. The severe impact of ND was first recognised in 1934. The disease is viscerotropic velogenic, and effects chickens twice each year, in March–April, the hottest period in the country, and again in August–September, the later part of the monsoon. The most susceptible age groups are birds under 3 months old and older birds over 5 or 6 months of age.

A natural balance has been achieved between host and disease, and though the country suffers annual chicken losses, they survive the sweeping effect of the disease and continue to contribute to the country's requirements. Birds are usually protected against ND by vaccination; eye drop vaccine for chicks and intramuscular injection for older birds. The former are given Weybridge F strain eye

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application at about 2 weeks of age, with Komarov strain given as a booster at 8 weeks after initial vaccination with F strain vaccine. It is recommended that Komarov vaccination be repeated at 6 month intervals for layer and breeder birds. The vaccines that are widely used in the country are produced locally at the biologics production division under the Livestock Breeding and Veterinary Department. At present, vaccination is limited to birds raised in intensive commercial farms, which are usually situated at peri-urban areas of the large cities and towns. Since vaccine must be stored or transported at low temperatures, vaccination is possible only when electricity or ice is available. Therefore, the use of vaccine is out of reach of village level farmers. Those poultry farmers who live in suburban areas and who are willing to have their birds vaccinated may do so by contacting veterinarians.

The veterinarians provide ND vaccination services free of charge to farmers, apart from the cost of poultry vaccine charged for at a reasonable rate by the department. At every veterinary office in large cities and townships, vaccination against common poultry diseases is provided by departmental veterinarians. Those assigned at village level may undertake poultry vaccination depending on their locality and the feasibility of vaccination. Normally, country practitioners serve as both animal health and extension workers. They hold discussions on animal health and animal husbandry with farmers whenever they visit their households. They give advice to the farmers on disease control and they may despatch any specimen to a nearby diagnostic veterinary laboratory whenever they have doubts about the causal organism. There is a central veterinary diagnostic division in Yangon and three regional diagnostic laboratories in Mandalay, Patheingyi and Taunggyi, which serve to help the local veterinarians in disease control and disease investigation. Table 2 gives the numbers of ND outbreaks, and mortalities, in 1990-91, as reported by the central laboratory and the 3 regional laboratories. It is clear that most of the cases were from nearby intensive poultry farms. There are likely to be cases not reported from rural backyard poultry farms, and it is assumed that such cases may be many times higher than the reported ones.

As each veterinarian may have responsibility for up to 10 to 12 villages (see Table 3), disease control is far from

Table 2. Newcastle disease incidence in Myanmar in 1990-91

Source	No. of outbreaks reported	Estimated morbidity ('000 birds)
Central Diagnostic Laboratory	94	4340
Regional Laboratories	110	338
Total	204	4678

Table 3. Veterinarians assigned at various administrative levels in Myanmar

State Division	Veterinarians			Total
	State & divisional level	Township level	Village tract level	
Kachin	1	12	26	39
Kayah	1	5	14	20
Kayin	1	8	19	28
Chin	1	10	14	25
Sabaing	2	39	128	169
Tanintharyi	1	11	17	29
Bago	2	31	112	145
Magway	2	26	108	136
Mandalay	2	31	140	175
Mon	1	11	41	53
Rakhine	1	17	50	68
Yangon	2	16	69	87
Shan	2	26	84	112
Ayeyarwady	2	26	116	144
Total	21	269	938	1228

satisfactory. In addition, the practical problems of vaccination at village level, such as storage, handling, and administration of vaccine are substantial. Therefore, there is a need to develop a simple, more effective method of vaccinating the chickens. The most appropriate way to overcome the problem of vaccination would be to incorporate a virus vaccine in the feed fed to chickens. If ND were brought under control, the population of village chickens would rise dramatically. It seems that the main possibility lies with the food pellet Newcastle V4 virus vaccine. Myanmar has been from the very beginning involved with the ACIAR Project, but because of circumstances beyond our control, the project has not been implemented as yet. Without implementation, which means lack of assistance being rendered in the needed areas, progress will be markedly retarded.

For the time being, arrangements have been made to carry out efficacy trials. If results are favourable, field trials will be undertaken and we would hope to be able to attend the next meeting with fruitful results. We are delighted to see more countries participating in workshops conducted by ACIAR, at which we can in turn share our experience with other participating countries. Like other countries, we are keen to see the project implemented in our country in the near future. In an experiment conducted before ACIAR involvement, it was shown (unpublished data) that V4 vaccine given by conventional routes protected against challenge with a local isolate of velogenic virus.

Poultry Production and Newcastle Disease in Vietnam

Tien Dung Nguyen*

Abstract

Most poultry raising in Vietnam is in the village sector, but cash returns to the villagers from this enterprise are irregular. Newcastle disease causes catastrophic losses in village chickens, infection usually entering villages through introduced birds. There is an urgent need for a vaccine suitable for use in village chickens.

ACCORDING to the General Department of Statistics, the total number of chickens in Vietnam in 1990 was 200 million. About 95–98% of the poultry population is in the household sector. The commercial raising of poultry is under the control of the Union of Poultry Enterprises (UPE), a State-run company at national level, which owns large poultry farms each having up to a hundred thousand chickens. Among other functions, the UPE has to keep the genetic poultry stock for supplying commercial chickens to farms of provincial level. While good performances are recorded in the farms of UPE, where there are no market or other impediments to development, in the household sector, performance is meagre and many obstacles limiting poultry production remain. All of these obstacles make the villagers' income from poultry production irregular. Therefore, villagers, who make up more than 80% of Vietnam's population, are not induced to take up poultry raising.

Village Poultry

Through the centuries, village chickens were selected for particular traits. Among these, hens with good maternal traits were the most important, as village chickens were, and still are, basically scavengers. As a result, they are of small size, weighing 1–2 kg at maturity.

Production system

Each village family has an average flock of 10 chickens, comprising a single cockerel and various hens that are used as reproducers (some families keep these birds for

years), other males that are killed for meat at specific festivities (New Year, wedding etc.) or sold at maturity, and other hens showing poor maternal traits that are used only as layers. The number of birds kept increases in the rice harvest period (May–June and October–November) when spilt grain around the house and in the rice fields provides feed for extra chickens and ducks. The number of chickens per family varies depending on the size of the family garden, availability of food (rice, cassava, maize etc.), market opportunities and local practice.

Village chickens are kept in free range and usually have to find food for themselves. They are enclosed at night for safety, in a coop constructed with local materials (bamboo, palm leaves, straw etc.). In this coop, each hen has a box made of bamboo or wood, with straw serving as a nest for laying and brooding. After laying a dozen or so eggs the hens enter a brood phase.

The most important indigenous chickens are known as the 'ri'. They are of small body size (hen live weight: 1.0–1.2 kg; cock weight up to 1.7 kg), resistant to variations of climatic conditions, attentive to any possible dangers (predators, strange objects etc.), energetic and wild. For consumption they are also preferred to other chickens for their tasty meat. However, it is difficult to point out exactly the genetic characteristics of a pure breed of 'ri' chickens. There has never been any breeding program followed by villagers. What is seen now around the country side are crossbreed chickens.

Village chickens are generally for family consumption but for villages around large cities they are also a source of extra income for the owners. Normally, chickens are sold live at the age of 5–6 months. Cockerels are more sought after in the market as people seek them for spiritual festivities.

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Factors influencing village poultry production

Poultry raising is a common practice of Vietnamese farmers, but has received little attention because it does not yet provide a regular income to villagers. In the lowland areas, small plot sizes restrict poultry raising, whereas in intermediate and highland areas, where larger plots are available, predators and restricted markets are the limiting factors. Above all, however, poultry diseases are the main reason discouraging villagers and limiting the development of poultry production.

Newcastle Disease in Vietnam

Newcastle disease (ND) was first recognised in Vietnam in 1956. Since then, outbreaks occur yearly causing heavy losses to poultry production. The viscerotropic form of the disease is the most frequently occurring. Vietnamese villages are separated from each other like islands in the paddy fields. Once ND enters a village, all unvaccinated chickens die. The infection normally enters via newly introduced birds. This is the most common source of the infection because already infected chickens are sold at low prices in village markets. Close to big cities, ND is a significant problem, whereas in remote regions it is not so serious. It seems likely that ND in Vietnam is closely related to the movement between chickens' localities. ND also appears to be seasonal, because it occurs most often at the beginning of winter (November–March), though this is no longer true in regions where new poultry production enterprises have been established.

Control

In the past people knew that their chickens would have problems when a chicken from the market was newly introduced into the village. Precautions concerning market chickens were and still are effective measures against ND. Vaccination was carried out for the first time in 1964. The vaccine was produced in the country using a mesogenic strain from China known as H1. Later, the strain La Sota was introduced in 1968. National veterinary authorities have directed the vaccination programs by organising small vaccination campaigns involving participation of primary and secondary pupils. These activities, involving simultaneous vaccination in a district or in one or many provinces at a time, have yielded significant successes, especially when NDV strain La Sota has been used in the drop vaccination form. However, since the adoption of new government policies in 1986, these activities are no longer undertaken and ND outbreaks

are again being reported around the country. A new approach is needed to meet this new situation. It can be said now that control work on ND in Vietnam has to follow the approach of other countries. Obviously, vaccination now has to be carried out by chicken owners, something that is already happening, particularly around the large cities. Generally, however, vaccination programs need cool chain conditions for long keeping and distribution of the vaccines. Furthermore, it is necessary to motivate and to educate farmers of the necessity of vaccination, and to teach them where to get and how to keep and to use the vaccine, the last being among the activities of vaccine suppliers. Some models of the new approach are under way and have shown good results. The main problem ahead is how to vaccinate all chicken flocks in a geographical area, or at least to maintain an acceptable level of immunity in that area. Past vaccination campaigns made people aware of the benefits of vaccination. The main problem now is in supplying an appropriate vaccine to farmers.

Newcastle disease research

Almost all research work on ND in Vietnam is conducted in the National Institute of Veterinary Researches (NIVR), Hanoi. The NIVT was established in 1968, as part of the Ministry of Agriculture and Food Industry. It has now 150 staff members and a branch institute at Nha Trang city (Central Vietnam). ND research has been undertaken by NIVT since its foundation. Virus isolation, virulence determination, vaccine, ND immunity and immunisation schedules have been topics of study. Vaccines used against ND in Vietnam were developed in the NIVR. Current work consists of epidemiological surveillance, using some genetic markers to follow NDV circulation. Other studies indicated that the number of HN proteins per virion varied depending on NDV strain. This greatly influences the results of HI tests if a specific strain is not used in every laboratory.

While research to develop commercial poultry enterprises is essential, as mentioned above, up to 98% of poultry production is in the village chicken sector meaning that the main national resource lies in this sector as, we believe, is the case in other countries of this region. NIVR work is now being reorientated to protect this resource. In addition, the relation between wild and/or migrating birds and ND occurrence in scavenging chickens is still obscure, not to mention the increasing commercial activities in the region demanding tough measures for controlling ND. Against this background, we see the ACIAR project to develop a heat-resistant vaccine as being very significant.

The Poultry Industry in Kenya with Particular Reference to the Newcastle Disease Problem

J.T. Musiime*

Abstract

The total poultry population in Kenya is about 23 million, 70% of which comprise scavenger chickens, the rest improved (European) breeds. The agricultural sector contributes about 25% to the annual gross national product (GNP), of which 4% is from the poultry sub-sector mainly from the intensive production system. With ever increasing prices of red meat, scavenger chickens have become the main source of animal protein, in the form of meat and eggs, for the rural human population which comprises about 80% of the country's total population.

Newcastle disease (ND) is the most important poultry disease in the country followed, in the descending order, by fowl typhoid and fowlpox. The literature on the ecology and epidemiology of ND in Kenya and the nature of the causative virus strains is sparse.

However, the limited information available shows that the disease is widely distributed throughout the country, and occurs mainly during the cold and dry periods in the year, peaking in June-July.

The disease causes 80-90% mortality in both improved and scavenger chickens wherever there are outbreaks. Losses due to ND mortality, around the Nairobi area mainly among the exotic chickens, were estimated at US\$0.6 million in 1989.

The disease is controlled by vaccination of chickens under the intensive system and occasionally scavenger chickens in some foci of outbreaks, using F strain vaccine. However, this method has not been entirely successful, especially among scavenger chickens. An alternative method is needed.

KENYA covers an area of 583 000 square kilometres and is bordered on the east by Somalia, on the north by Ethiopia, on the north-west by Sudan, on the west by Uganda and on the south by Tanzania. It has a 400 kilometre coastline on the south-east.

Lying between 3°N and 5°S, 34°E, the country lies within the equatorial zone. It is almost bisected by the equator and the 38°E longitude.

The population, according to the 1989 census, is 24 million, with an annual growth rate of 3.8%, which has come down from 4.0%. About 80% of the population live in rural areas.

Kenya is mainly an agricultural country. However, only about 20% of the country is suited to crop production. The remainder is either semi-arid or arid and supports mainly cattle production under the pastoral system.

The agricultural sector contributes about 25% to the

annual gross national product (GNP) of which 4% is from the poultry sub-sector, mainly the intensive system under which European (exotic) chickens are kept. The country's livestock population is estimated at 12.1 million cattle, 8.5 million goats, 7.3 million sheep, and 23 million poultry. About 70% of the poultry population is comprised of scavenger chickens; the balance is made up of improved (European) breeds.

The Importance of Scavenger Chickens

The prices of red meat, milk and poultry products (eggs and meat) from the intensive system have been gradually increasing in the recent past, especially in the urban areas. This has led to most people not being able to consume these animal products regularly because of their high cost. Most people, especially in the rural areas, depend mainly on eggs and poultry meat from scavenger chickens as their source of animal protein. Normally, the price of a whole

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scavenger chicken (average dressed weight is approximately one kilogram) would be the same as the price for half a kilogram of a dressed broiler chicken. Moreover, the eggs produced by the scavenger chickens are much cheaper than the eggs produced by intensively raised exotic chickens. This differential is influenced by a system of price control.

Most rural households keep a minimum of ten scavenger chickens. These would consist of one or two cocks and the rest would be hens. Each hen lays 10–15 eggs per batch and there are normally four batches a year. With a hatchability of 80%, each hen produces 8–12 chicks per batch. About 60% of these would survive predators and other causes of chick mortality to reach adulthood. The length of time it takes a chick to mature depends on, among other things, the availability of food. Usually the chickens are left to scavenge for their living and with an occasional supplement of owners' food leftovers. The chickens are rarely housed during the day. However, the chicks and their mothers are housed where the population of predators is very high.

As the chicks mature, the oldest chickens are either killed and eaten or are sold off to produce income. Besides supplying poultry meat and eggs for human consumption, the scavenger chickens are a source of petty cash. They also fulfil a social function — a visitor may be given a chicken as a gift on his departure.

Newcastle Disease in Kenya

Newcastle disease (ND) is the most important poultry disease in the country followed, in descending order, by fowl typhoid and fowlpox. Published information on disease outbreaks, number of positive cases diagnosed, epidemiology and the ecology of the disease is scanty. What information is available can be obtained from the Annual Reports of the Veterinary Department and the report of the work done by Nyaga (1982).

The disease was first encountered on the Mombasa Island (Daubney 1936) and later spread throughout the country. To date, it is still widely distributed. Mortality among the exotic breeds is usually more than 90% and 80–90% among scavenger chickens. Outbreaks are usually associated with the introduction of scavenger chickens from elsewhere. The owners of the scavenger chickens are well aware of the clinical signs of the disease and as soon as some birds start to die of the disease, the rest are quickly sold off. Most of them would be in the incubation period. This inevitably helps to spread the disease.

Intensive poultry production is concentrated in the Central Province, Nairobi area and the Rift Valley Province. The indigenous poultry flocks are concentrated in the eastern, coast, Nyanza and western provinces.

The records show that the larger number of ND outbreaks have been recorded in the Central and Rift Valley Provinces (see Table 1) and have occurred during the cold and dry periods in the year, with peaks in the June–July period. What is normally recorded is the tip of an iceberg, as the majority of the outbreaks that occur in the country, especially among the scavenger chickens, are not reported.

In the Nairobi area alone, there were 36 outbreaks recorded in 1989 and 17 in 1990. Most of these outbreaks were among exotic chickens kept on commercial farms. Losses due to mortality among exotic birds in the Nairobi area were estimated at US\$0.6 million in 1989. No attempt has been made to estimate the economic losses due to ND either among the exotic or scavenger chickens in the whole country.

Control of Newcastle Disease

Vaccination against ND was introduced into Kenya in 1958. An inactivated vaccine was used. By 1965 the incidence of the disease had decreased remarkably.

Table 1. Distribution of Newcastle disease outbreaks by provinces (1957–1971)

Province	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Nyanza	4	1	2	3	E	1	1	E	2	2	1	6	3	2	8
Rift Valley	2	3	14	2	5	10	13	E	13	14	23	23	32	7	10
Southern	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—
Central	63	16	29	22	21	6	23	E	3	8	5	9	11	6	7
Coast	E	2	7	E	2	E	E	E	E	1	8	2	E	2	—
Northern	—	1	—	—	—	—	—	E	—	—	—	—	—	—	—
Western	—	—	—	—	—	—	E	E	E	1	E	11	6	1	2
Eastern	—	—	—	—	—	—	—	E	—	15	—	6	9	1	6
Nairobi	—	—	—	—	—	—	—	—	—	—	9	—	6	—	—
North	—	—	—	—	—	—	—	—	—	—	1	1	3	—	1
Eastern	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

E = endemic

Thereafter, however, there was a dramatic increase in the disease incidence. There was again a decrease in the incidence of the disease for the period 1972–73 with the introduction of the F strain vaccine. The F strain vaccine is still in use. Broiler chicks are vaccinated at 18–21 days old, followed by a booster at 8–9 weeks. Layer chicks are similarly immunised. However, they are given a second booster at 18–22 weeks, again using the F strain vaccine. Previously, Komarov was used as the second booster for the layers, but farmers prefer the F strain vaccine, and the use of Komarov was therefore stopped in 1988.

Vaccine production recently became the responsibility of a parastatal body which charges for the vaccines it produces. In 1989, when the ND vaccine was still being produced by a government laboratory, the charge was 10 Kenya cents per dose (US\$ = 29 Kenya shillings, 1 sh. = 100 cents). A total of 13,549,500 doses was produced in that year, with nearly all doses sold. In 1990, when the parastatal body took over, the charge was raised to KShs.2 per dose (950% increase). The farmers refused to buy the vaccine. The charge was then reduced to 30 cents per dose. Some of the total 10,460,000 doses produced in 1990 have not yet been used.

Vaccination is mainly carried out on commercial farms and in some foci of outbreaks among scavenger chickens near the urban centres. The owners of the scavenger chickens are not keen to have their birds vaccinated when

there is no disease outbreak. These birds are a source of infection to other scavenger chickens and to the commercial farms.

Conclusion

Scavenger chickens in Kenya have a great potential for the provision of poultry meat, eggs and cash to the rural communities. However, their productivity is inhibited by the widespread occurrence of ND, to which they are highly susceptible. The current vaccination program has not been successful in controlling the disease. Outbreaks have occurred in peri-urban areas where vaccination has been practiced regularly. In order to control the disease effectively, studies are needed of the epidemiology of the disease and for the biological characterisation of the causative virus strains. Consequently, a vaccination program with an effective delivery system of the vaccine(s) should be developed.

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Poultry Disease in Africa and the Newcastle Disease Problem: an Overview

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Abstract

The majority of people in Africa live in rural areas and earn very low incomes. Almost every homestead has some chickens and these provide the cheapest source of animal protein in the form of eggs and meat. Chickens are also a ready source of petty cash for subsistence. Greater attention should be paid to factors that limit the productivity of scavenger chickens, especially the Newcastle disease (ND) problem, for the benefit of rural communities.

THERE is an enormous deficit between the animal protein produced in Africa and that required to feed the continent's 550 million people. The deficit is attributed to low productivity of livestock rather than low numbers.

Cattle, sheep and goat populations are 180 million, 187 million and 151 million, respectively. These figures represent 14.5%, 15%, and 29% of the world total, respectively. Their productivity is 6.8% of world beef, 0.6% of world milk for cattle, 16% of world sheep and goat meat and 11.5% of the world sheep and goat milk. In an attempt to satisfy the demand for animal protein, most of the African countries continue to import milk and meat worth millions of dollars. These imports would have been much higher if it were not for the existence of a poultry industry in most countries in the continents.

Poultry Industry in Africa

The poultry industry in Africa involves both scavenger chickens and exotic (European) breeds. The latter are kept under intensive conditions for commercial purposes.

The poultry population in the continent is 1690 million (FAO-OIE-WHO 1990), scavenger chickens far outnumbering the exotic breeds. This may be a low estimate, because while it is possible to get an accurate figure for commercial poultry, it is difficult to do the same for scavenger chickens. For the latter, the estimate made is usually based on the average chickens per household.

The bulk of animal feed, including that for poultry, consists of food grains, especially maize. Moreover, quite a large proportion of the African people depend on food grains for their staple food, so that there is competition between them and livestock for the available food grain. To make the situation worse, the human population has been increasing while grain production has been declining. These factors have been responsible for the high costs of animal feeds, including those for poultry. Correspondingly, the prices for commercial poultry products have become quite high. For example, the price for one kilogram of a dressed broiler chicken in Nairobi is K.Shs.70.00 (1US\$=29 K.shs.), much higher than European prices.

Most of the people of Africa live in rural areas and have a very low income. They cannot, therefore, afford to buy poultry products from the commercial farms. Scavenger chickens are their main source of animal protein. In the first instance, they are cheap to produce. Secondly, people find it much easier to kill a chicken for family consumption than, say, a goat, sheep or cow. The larger livestock are kept mainly for prestige or as a sign of wealth. The higher the number of animals one keeps the higher is one's status in the community and also the wealthier is one regarded.

Also, the indigenous birds provide a larger proportion of the table poultry trade. They are preferred to the exotic birds for the staple dishes, usually curries, of the lower- and middle-grade hotels and restaurants.

Live indigenous birds are on sale wherever there is a market. Large numbers are transported in large wicker baskets, on lorries, from rural to urban areas.

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The Newcastle Disease Problem in Africa

Newcastle disease (ND) has a severe economic impact on the chicken industries of Africa. Countries that responded to a questionnaire we circulated have reported very high mortalities both in commercial and scavenger chickens. Mortality in the former is usually higher than in the latter. However, in scavenger chickens, mortality can approach 100% if the disease is newly introduced. For example, in 1985, nearly all the scavenger chickens in Mutare Province of Zimbabwe were killed following the introduction of ND from neighbouring Mozambique (Hargreaves, pers. comm.). Zimbabwe had previously been free of the disease for a number of years.

In most of the eastern African countries, the disease flares up in the scavenger chickens during the dry seasons, which also tend to be windy (Kombo, Msiska, Mukiibi and Wamukoya, pers. comm.). For other countries that have reported the disease to us, there has been no indication of seasonality in the disease. What seems to be clear from the reports is that the disease is still very prevalent (Table 1).

Some countries take ND very seriously, to the extent that they have had it as one of the notifiable diseases for a long time. These countries are Algeria, Angola, Botswana, Burkina Faso, Cameroon, Ghana, Kenya, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe (OAU/IBAR 1990).

Control of Newcastle Disease in Africa

The main control method for ND is by vaccination using the conventional vaccines. Malawi has implemented vaccination with V4 thermostable strain vaccine in commercial flocks only.

Generally, routine vaccination is undertaken in the intensive farms. For scavenger chickens, vaccination is done only around the foci of disease outbreaks.

For vaccination to be an effective method for controlling ND, there is a need to study the epidemiology of the disease and the causative virus strains in each country.

The African countries themselves are aware of the limited success they have achieved in controlling the disease. They have, therefore, commissioned the Pan African Veterinary Vaccine Centre (PANVAC) to implement quality control measures for ND vaccines used on the continent. ND vaccines have thus become priority number three after rinderpest and contagious bovine pleuropneumonia vaccines. PANVAC was also recently requested by participating countries, to coordinate the

Table 1. Reported outbreaks of newcastle disease in Africa, 1985-1991.

	1985	1986	1987	1988	1989	1990	1991
Algeria	-	-	-	3	2	x	x
Angola	2	5					
Botswana	8			38	15	x	
Burkina Faso	9					x	
Cameroon							
Chad							x
Congo						x	x
Cote D'Ivoire						x	x
Egypt	33	19	20	17	8		x
Ethiopia							x
Ghana	27	28	4	75	79	x	x
Kenya	3			3	8	x	x
Lesotho				35		x	
Madagascar	40	22	11		29	x	
Malawi			7	1		x	
Mali	1						x
Mauritius			182	1	10		
Mauritania			4				
Mozambique		2				x	x
Namibia						x	x
Niger							
Nigeria	13	6	4	3	1		x
Senegal						x	
Sudan						x	
Swaziland	1						
Togo					2		
Tunisia	2	10	28	27	79		
Uganda							
Zaire		5				x	
Zambia		9			51	x	
Zimbabwe	2					x	x

pilot trials of V4 thermostable vaccine in scavenger chickens in Africa. The results obtained in Southeast Asia are therefore of much interest to PANVAC in particular, and Africa in general.

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Summary and Recommendations

Summary and Recommendations

Conclusions

1. Velogenic Newcastle disease is a problem in village chickens

In many countries Newcastle disease is the most important cause of loss in village chickens. In a very few, Newcastle disease is regarded as a less serious problem and in some countries, mostly islands, Newcastle disease does not occur.

2. One solution is a thermostable vaccine that can be taken to remote areas with minimal reliance on a cold chain

In Websters heat-stable V4 vaccine we have an extremely safe vaccine that has protected against challenge with all the velogenic strains of Newcastle disease virus against which it has been matched in four continents.

3. If village chickens can be caught, application of vaccine by conventional methods is most efficient

In some countries where chickens are well housed, the most efficient vaccination regime will be to utilize the thermostability of Websters V4 vaccine combined with individual vaccination.

4. In many areas, if village chickens are to be vaccinated, the vaccine will have to be delivered on food to unconfined, scavenging chickens

Websters V4 vaccine has been used successfully as a food vaccine in laboratory trials and in the field in several countries. Successful vaccination has been judged by serological testing, by experimental challenge and by analysis of mortality data collected in the field. However, the protection conferred can sometimes be erratic but current research offers a solution to this problem.

5. Food vaccination is to be used for village chickens over a wide area of Malaysia

The Malaysian control scheme will use vaccine mixed in bulk in ribbon blenders in central locations onto wheat grains that have received no other treatment. The pre-mixed grain will be transported to villages. We congratulate our Malaysian colleagues on rapidly reaching the implementation phase of the project, but note that this solution to the problem of oral vaccination will not be applicable in all countries. It is understood that other countries are planning implementation phases that will use other methods to prepare their food vaccines.

6. Successful implementation of this project could eventually improve the well-being of millions of villagers in many countries

Computer models indicate economic benefits will be gained with relatively modest levels of protection.

Recommendations

1. There is a need to perfect food delivery systems

Dr Rob Cumming and his group reported on methods for treating grain that reliably allow recovery of virus from grain after 18 hours and that reliably produce antibodies in chickens when fed after this time. The efficacy of this method should be established in challenge trials as a method of urgency.

2. The introduction of thermostable vaccines to further countries should commence with pilot trials

There seems to be no requirement to demonstrate the antigenicity of Websters V4 vaccine anew in further countries. Thermostable V4 could be used in these countries as a conventional vaccine without further research. However, if food vaccines are to be used, suitable methods for delivering vaccine on locally available foods must be determined.

3. Pilot trials will require team efforts

It is essential that people with diverse skills — including poultry experts, economists, epidemiologists and virologists — be included in planning and performing pilot trials and in later implementation.

4. Extension must be a vital part of any new vaccine program

Skilled extension workers are required, not only for the implementation phase of projects, but for the successful initiation of pilot village trials. Community participation is essential for the success of these programs.

5. The control of Newcastle disease should lead to further studies that will allow the most efficient exploitation of the village chicken

Village chickens have been a neglected resource because of the ravages of Newcastle disease. As Newcastle disease is controlled with thermostable vaccine, the full economic potential of the village chicken and its scavenging environment must be defined and developed. Obvious problems will be the large brooding losses that occur in all countries and the eventual need to control chicken populations to protect the scavenging environment.

6. Consideration should be given to the future funding of village chicken programs

Now is the time to consider approaches to suitable agencies for funding new pilot projects, and existing and new implementation programs. Implementation programs should allow for serological monitoring of vaccine efficacy. Funding will also be required for the future studies that will establish a science of village chicken production.

7. Future workshops will be required to monitor the progress of vaccination programs and other studies on village chickens

This workshop, and the previous workshop held in Kuala Lumpur, have assisted greatly in the exchange of information on Newcastle disease vaccines for village chickens and in co-ordinating research. With the completion of the ACIAR project in 1991, possibly APHCA would be a suitable co-ordinating body.

8. Minimal standards for safety and potency should be established for vaccines for use in village chickens

Even if vaccines for use in village chickens are not produced in specific-pathogen-free eggs, they should meet prescribed minimal standards.

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