

The Role of Scavenging Poultry in Integrated Farming Systems in Ethiopia

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Abstract

This paper focuses on the role of scavenging poultry in integrated farming systems and is mainly based on previous studies and past research and development attempts to improve scavenging poultry in Ethiopia. Village poultry production is an integral part of a balanced farming system and has a unique position in the rural household economy, supplying high quality protein to the family. In this paper, the present structure, socio-economic aspects, constraints, potential and future prospects of scavenging poultry in the mixed farming systems are described, and recommendations are also made to change the present scavenging system to semi-scavenging system.

KEY WORDS: Poultry, scavenging, semi-scavenging, village, Ethiopia, mixed farming system

Introduction

Rural poultry production in Ethiopia represents a significant part of the national economy in general and the rural economy in particular, and contributes 98.5 and 99.2% of the national egg and poultry meat production, respectively (AACMC, 1984), with an annual output of 72,300 metric tonnes of meat and 78,000 metric tonnes of eggs (ILCA, 1993).

Comparatively little research and development work has been carried out on village poultry, despite the fact that they are more numerous than commercial chickens, accounting for around 99% of the total number in the country. Studies carried out at the College of Agriculture, Alemaya (Bigbee, 1965) and Wolita Agricultural Development Unit (WADU) (Kidane, 1980) and by the Ministry of Agriculture (1980) indicated that average annual egg production of the native chicken was 30-60 eggs under village conditions and that this could be improved to 80-100 eggs on-station.

A recent study at Asela Livestock Farm revealed that the average production of local birds around Arsi was 34 eggs/hen/year, with an average egg weight of 38 g (Brannang and Persson, 1990). These results look unimpressive when compared with egg-laying exotic breeds which can produce more than 250 eggs/hen/year, with an average egg weight of 60 g. They show that local birds are poor producers of small sized eggs. But smallholder poultry production using unimproved stock can be the most appropriate system in practice, with low input levels that makes the best use of locally available resources. Village poultry are important providers of eggs and meat as well as being valued in the religious and cultural life of society in general and the rural people in particular.

As pointed out by Sonaiya (1990), in recent years, rural poultry have assumed a much greater role as suppliers of animal protein for both rural and urban dwellers. This is because of the recurrent droughts, disease outbreaks (rinderpest and trypanosomiasis) and decreased grazing land, which have resulted in significantly reduced supplies of meat from cattle, sheep and goats. Poultry is the only affordable species to be slaughtered at home by resource-poor farmers, as the prices of other species are too high, and have increased substantially in recent years. Consumption of pork is not allowed for religious reasons for most Ethiopians (Orthodox Christians and Muslims) but fortunately there are no such cultural or religious taboos in relation to the consumption of poultry and poultry products.

Ten years ago, per capita consumption was about 57 eggs and about 2.85 kg of chicken meat per annum in Ethiopia (Alemu, 1987), which are very low figures by international standards. Although there are no current

data on the present per capita consumption of poultry products, a similar or even declining trend is probable because the population of Ethiopia has increased by about 3% per annum over the last ten years without any marked increase in the production of poultry meat and eggs. Innovative ideas and programmes are therefore required to promote rural poultry production for the improvement of rural household incomes and nutrition.

Poultry production is an effective means of transferring wealth from the high-income urban consumers to the poor rural and peri-urban members of the community. Small scale poultry development should therefore concentrate on the rural and peri-urban areas of the country. The focus of this study was on villages in the central highlands of Ethiopia.

Present Structure of Poultry Production in Ethiopia

The total poultry population in Ethiopia is estimated to be 56.5 million (ILCA, 1993). Poultry production systems in Ethiopia show a clear distinction between traditional, low input systems on the one hand and modern production systems using relatively advanced technology on the other (Alemu, 1995). Ninety-nine per cent of the population consists of local breed types under individual farm household management (Alamargot, 1987), and the remaining 1% of birds are mainly in state-run modern production systems, with a very small proportion in private units. Of the total national egg and poultry meat production 98.5 and 99.2% respectively are contributed by local birds (AACMC, 1984), resulting in an annual output of 72,300 metric tonnes of poultry meat and 78,000 metric tonnes of eggs.

Large-scale Commercial Systems

Modern poultry production started in Ethiopia about 30 years ago, mainly in colleges and on research stations. The activities of these institutions mainly focused on the introduction of exotic breeds to the country and the distribution of these breeds to farmers, including management, feeding, housing and health care packages.

The history of poultry production in the industrialized countries may offer some basic knowledge and guidelines for poultry development in the

developing countries as a whole and in Ethiopia in particular, but in view of the particular conditions in different countries and regions, specific research and development approaches are needed to determine which are the optimum production systems and development strategies.

Most of the research work is still being carried out on intensive poultry production, with modern housing and sophisticated feeding systems. However, the great majority of poultry production is based on extensive rural production systems where the results of current research are often not applicable.

Today, a number of large commercial state farms have been established and private poultry farms are starting to operate in the country. This would seem to be a positive trend in increasing the supply of animal protein for the Ethiopian people, whose primary source of protein is of plant origin, because poultry are efficient converters of by-products and grains into eggs and meat, and have a fast turnover and rapid growth rate. In spite of these advantages, including intensive poultry production in the livestock development strategy must be questioned, due to the fact that commercial poultry compete with human beings for scarce food grains. This statement is justified if we consider the composition of diets used on the industrial poultry farms, where the major ingredients are high quality cereals like maize and wheat (AACMC, 1984).

If we consider commercial poultry production under Ethiopian conditions, where there is a national shortage of grain to feed an ever-increasing human population and a negative trade balance, then allocating hard currency to import breeding stock, medicines, vitamin-mineral pre-mixes and concentrates to support intensive poultry farms will involve critical political as well as economic decisions. So, in a country like Ethiopia, the outcome will be the converting of food that resource-poor people can usually afford to buy, to smaller amounts of luxury food items that only the minority wealthy members of the society can afford.

No attempts have been recorded to evaluate the performance of exotic birds under local farmer conditions. The only serious on-station attempt carried out in Ethiopia was a comparative study of the performance of six

different exotic breeds, namely: Brown Leghorn, White Leghorn, Rhode Island Red, New Hampshire, Light Sussex and Barred Rock at Debre Zeit Agricultural Research Centre. This study showed that the White Leghorn was the best performing exotic layer breed (DZARC, 1984).

Rural Poultry Production Systems

There is no generally accepted definition of rural poultry production, and various production systems have been described by a number of authors, including Huchzermeyer (1967), Aini (1990), Cumming (1992), Alemu (1995) and Tadelle and Ogle (1996a). The production systems are characterized as including small flocks, with nil or minimal inputs, low outputs and periodic devastation of the flocks by disease. Birds are owned by individual households and are maintained under a scavenging system, with little or no inputs for housing, feeding or health care. Typically the flocks are small in number with each flock containing birds from each age group, with an average of 7-10 mature birds per household, consisting of 2-4 adult hens, a male bird and a number of growers of various ages. Tadelle and Ogle (1996a), Gunaratne *et al.*, (1992) and Cumming (1992) also described village poultry flocks in Asia as including 10-20 birds of different ages per household. According to AACMC (1984), in Ethiopia there is an average of six indigenous birds per household and, according to Sonaiya (1990), the average flock size in Africa ranges from 5-10 birds. As described by Tadelle and Ogle (1996a), the village poultry production system is characterised by minimum inputs, with birds scavenging in the backyard, and no investments beyond the cost of the foundation stock, a handful of grain each day and possibly simple night enclosures.

Past Research and Development Attempts

Comparatively little research and development work has been carried out on village chickens, despite the fact that they are usually more numerous than commercial chickens in most developing countries (Cumming, 1992) and they have been marginalized by planners and decision makers (Panda 1987), which is certainly true in Ethiopia. Few attempts have been made to increase protein supply by improving the egg and meat production

potential of local birds, and upgrading and crossbreeding with exotic germplasm has been the main focus of the research and development organizations. For the last three decades, scientists and the government have promoted schemes in which cockerels from selected strains are reared up to 15 to 20 weeks of age, mainly on government poultry stations, and then exchanged for local cockerels owned by rural subsistence farmers.

The study reported by Tadelle and Ogle (1996a) in the central highlands of Ethiopia shows that there has been an introduction of exotic breeds to the three villages at various times and in different forms, as cockerels, pullets and fertile eggs, but their impact in upgrading the village chickens has been minimal. The farmers were given advice on improved feeding and housing and were asked to remove all remaining local cockerels. In addition, improved hens were introduced to boost egg production in co-operative based intensive poultry farms in rural Ethiopia, but most of these projects collapsed, mainly due to inadequate feed supply, management, medicines and discontinuation of the schemes. However these approaches led to only limited improvement, due to the high mortality rate of the modern breeds because of their lack of adaptation to the rural environment, poor management, ultimate discontinuation of the schemes and, above all, the farmers' lack of interest and awareness, because the programmes were usually planned without farmer participation and without parallel improvement in management and feeding.

Many cross-breeding projects failed because the crosses were not accepted by local people, who feared they would be vulnerable to harsh village conditions. Above all, those development strategies did not pay attention to local social and cultural aspects of poultry production. For example, farmers prefer to have double-combed cocks for sacrifice purposes, in addition to their colour preferences (Tadelle and Ogle 1996a). Local scavenging chickens, in addition to providing cash income, have nutritional, cultural and social functions which require consideration from planners, professionals and farmers, which is rarely given. However, planning and execution of research and development work on local birds could result in considerable improvement in egg production

performance, and a reduction in the high chick mortality.

Tadelle and Ogle (1996) described the scavenging feed resource base (SFRB) for local birds in the central highlands of Ethiopia as variable, depending on the season and rainfall. This is in agreement with the results from three different production systems (two from Sri Lanka and one from Indonesia) (Cumming, 1992 and Roberts, 1992). So strategic supplementation of birds according to age and production status can be a suitable solution.

Generally, non-genetic factors such as poor nutrition, disease (mainly Newcastle disease) and other management practices have a much greater effect than genetics on production parameters under scavenging systems. In the results of an on-farm trial in the central highlands of Ethiopia, vaccination for Newcastle disease, improved feeding systems, regular provision of water and small night enclosures for scavenging birds were very important as a way of achieving optimum production.

Socio-economic Aspects of Rural Poultry Production

Rural poultry represent a significant part of the rural economy. This segment of production in Africa as a whole represents an asset value of US\$ 5.75 billion (Sonaiya, 1990). In addition to their contribution to high quality animal protein and as a source of easily disposable income for farm households, rural poultry integrate very well and in a sustainable way into other farming activities, because they require little in the way of labour and initial investment compared to other farm activities (Tadelle and Ogle, 1996a). A number of authors, including Veluw (1987), Sonaiya (1990), and Gunaratne *et al.* (1992), have also reported that rural poultry play a significant role through their contribution to the cultural and social life of rural people.

The existence of poultry in the household does not imply necessarily that the farmers are willing and in a position to expand poultry production. Experience has shown that intensive persuasion is needed to convince them to introduce regular watering and feeding, to clean the birds' night shelter and to take care of the young chicks, before starting any research or development programme to attain the genetic potential of the local birds. The first critical step in rural poultry development is

therefore the encouragement of farmers to change their attitude towards poultry keeping and the traditional system.

It is very difficult to determine the most important purpose of keeping birds in each household because it is impossible to compare the spiritual benefit of sacrifice with the financial benefit of a sale. A ranking of purposes based on the number of birds used has very little to do with the order of importance, and understanding this is a considerable challenge for development workers. For a better understanding of the role played by poultry in the lives of rural people, it is necessary to know exactly the purposes for which households keep poultry. The five major uses and benefits of poultry and eggs in rural societies in the central highlands of Ethiopia are summarized as follows: eggs for hatching (51.8%), sale (22.6%) and home consumption (20.2%), and production of birds for sale (26.6%), sacrifice (healing ceremonies) (25%), replacement (20.3%) and home consumption (19.5%). In some cases farmers give live birds (8.6%) and eggs (5.4%) as a gift to visitors and relatives, as starting capital for youths and newly married women. They also invite special guests to partake of the popular dish "doro wat", which contains both chicken meat and eggs and is considered to be one of the most exclusive national dishes (Tadelle and Ogle, 1996a), as confirmed by Veluw (1987) in Northern Ghana. Birds are also given as sacrificial offerings in traditional worship, and finally they perform a valuable sanitary function in the villages through eating discarded food and cockroaches, for example.

The feed resource base for the scavenging chicken production system described has no alternative use and, if they were not present, other scavengers, particularly dogs and crows would perform this function, with no associated benefit to the farming community.

Poultry keeping in most of the developing countries is the responsibility of women. Tadelle and Ogle (1996a), in a study of three villages, found that it is the women that look after the birds, and the earnings from the sale of eggs and chickens are often their only source of cash income. It is therefore important to actively involve women in the process of poultry improvement, a feature which has been neglected in the past. Most of the poultry extension workers, vaccinators and key poultry farmers are men. In some parts of Ethiopia, contacts between

women and male extension workers are restricted by cultural and religious factors and information has to be passed indirectly through their husbands. It is important to plan poultry development projects in such a way that women participate actively as poultry advisers, extension workers, and vaccinators, as well as poultry farmers.

Input-output Relationships

Despite the fact that more than 70% of the poultry population in Africa (Table 1; Sonaiya, 1990) and 99% of the poultry population in Ethiopia (Alamargot, 1987) consists of local birds, their contribution to farm household and national income is not in proportion to the high numbers. Productivity is observed to increase in direct proportion to the level of confinement (Sonaiya, 1990) and other feeding and management factors, up to a certain level of production corresponding to the upper limits of the genetic potential of the local birds.

This system of production, although it appears primitive, can be economically efficient because, although the output from the individual birds is low, the inputs are even lower or virtually non-existent (Smith, 1990). The low output is expressed as low egg production, small sized eggs, slow growth and low survivability of chicks (Smith, 1990; Tadelle and Ogle 1996a) but small management changes, for example regular watering, night enclosures, discouraging them from getting broody, vaccination for common diseases and small energy and protein supplements can bring about significant improvements in the productivity of local birds (Tadelle and Ogle 1996c). In the central highlands of Ethiopia, indigenous birds kept under semi-intensive management conditions produced 100 eggs per annum and under this system of management ten clutches of eggs were produced per year as compared with three to four produced under normal scavenging systems (Tadelle and Ogle, 1996c). In general, with minimal additions of inputs, improving the existing management and changing the attitudes of farmers can bring about considerable improvements in terms of egg production, growth and increasing the level of survival.

Table 1. Percentage contribution of local birds in selected African and Asian countries to the poultry population.

Country	% Contribution	Reference
Sri Lanka	28	Fonseka (1987)
Zimbabwe	30	Kulube (1990)
Cameroon	65	Agbede <i>et al.</i> (1990)
Cote d'Ivoire	75	Diambra (1990)
Kenya	80	Mbugua (1990)
Gambia	90	Andrews (1990)
Malawi	90	Upindi (1990)
Nigeria	91	Adene (1990)
Ethiopia	99	Alamargot (1987)
Bangladesh	99	UNDP/ FAO (1983)

Feed Resources and Requirements

The feed resource base for rural poultry production is scavenging and consists of household waste, anything edible found in the immediate environment and small amounts of grain supplements provided by the women. As shown by Tadelle and Ogle (1996a and b), the scavenging feed resource base (SFRB) is not constant. The portion that comes as a grain supplement and from the environment varies with activities such as land preparation and sowing, harvesting, grain availability in the household and season and the life cycles of insects and other invertebrates. From the results of the same work, it is also possible to conclude that protein supply may be critical, particularly during the drier months, whereas energy may be critical during the rainy season, which agrees with the conclusions of Cumming (1992), who describes the feed resource as variable, depending on the season and rainfall. In the absence of an event which diminishes the flock biomass (number * mean live weight), such as disease or occurrence of a major festival, the village flock will normally be at the maximum biomass that can be supported by the SFRB. Any additions to the village flock which increase the biomass will result in increased survival pressure and selection against the

weakest members of the flock.

According to the finding of Tadelles and Ogle (1996b), the feed resource is deficient in protein, energy and probably calcium for layer birds, and this is confirmed from the results of supplementation trial, which show that supplementation of local birds with food sources containing energy, protein and a calcium source brings a considerable increase in egg production.

Feed Requirements and Supplementation of Local Laying Hens

There is no doubt that feed supply is one of the main constraints to rural poultry production, and it has been calculated that scavenging birds are usually capable of finding feed for their maintenance needs and about 40 eggs per year, but higher levels of production require supplementary feed. The nutritional status of local laying hens from the chemical analysis of crop contents, assuming this accurately reflects the feeds consumed, indicates that the %DM (52.3 ± 12.5), CP (9.1 ± 2.3), Ca (0.9 ± 0.4), P (0.7 ± 0.3) and ME (11.9 ± 0.9 KJ/g) were below the requirements for egg production, indicating the importance of supplementation.

Compound feeds are usually not available in remote areas, or are too expensive, so it is therefore necessary to use locally available materials such as household waste and cheap conventional and non-conventional feed resources such as brans and oil-seed cakes. The choice of raw materials for poultry feed is limited and it is not possible to formulate balanced diets in rural Ethiopia. Sub-optimal supplementary rations may be economically justified under rural conditions and accordingly this supplementary feeding should complement, but not replace, the feeds scavenged by the birds and must be tested and examined from an economic point of view. Special attention will need to be paid to local sources of minerals and vitamins, although scavenging birds would normally find a significant proportion of their requirements for vitamins and trace minerals, although probably not for calcium in the case of laying hens.

According to Tadelles and Ogle (1996c), it is possible to attain daily production per hen of over 30% using a supplement of 30 g/day maize and 30 g/day noug cake, 28% from 30 g maize and over 20% from 30 g

per day per bird noug cake which is more than double the 13.9% from scavenging only. This result is also supported by the study of Islam *et al.* (1992) who showed that by giving a supplement that provided 30% of the daily energy and protein requirements of local birds it is possible to produce as many eggs as the un-supplemented Fayoumy breed in the villages, and that egg production from scavenging birds increased by a factor of three when they received a supplement covering 50% of their dietary needs.

Protein Requirements of Local Laying Hens

The protein requirement of high producing laying hens varies from 16-18% of the diet, to meet the needs of egg production, maintenance and growth of body tissues, and feather growth, but this also depends on the energy content of the feed. In addition to the above, the feed consumption and protein requirements are influenced by a number of factors, the most important being size of the bird, stage of production and ambient temperature.

It is possible to estimate the requirements for protein factorially. According to Nesheim *et al.* (1979), a fresh egg contains 66% water, 12% protein, 10% fat, 1% carbohydrates and 11% ash. The average weight of a local hens egg is 38 g (Sazzad, 1986; Brannang and Persson, 1990; Tadelle and Ogle, 1996c). Thus a 38 g egg contains 4.56 g protein and, at an efficiency of protein utilization of 55% (Scott *et al.*, 1982), hens must consume 8.29 g protein per egg. Harris, (1966) indicated that the endogenous nitrogen excretion is estimated to be 2.55 g per day for a bird weighing 1.14 kg. According to Scott *et al.* (1982), protein required for feather growth is 0.49g/bird/day. The sum total of calculated protein requirements for all these functions is 11.194 and 11.317 g/day for birds producing a 35g egg in phase one and a 38 g egg in phase two of lay. As described by Tadelle and Ogle (1996b), the mean crude protein (CP) in the crop contents is $9.1 \pm 2.3\%$ which is below the above calculated requirement of the local laying hens. Protein deficiency was even more serious in the short rainy and dry seasons, when the CP content of the crop contents was 7.6% and 8.7%, respectively. This is confirmed by the results of the supplementation trial reported by Tadelle

and Ogle (1996c), where provision of additional protein in the form of noug cake increased egg production by a factor of two as compared with scavenging birds not receiving a supplement.

Energy Requirement of Local Laying Hens

In moderate environmental temperatures, high producing White Leghorn hens require 300-320 kcal of metabolizable energy per hen per day. Local birds are low producers of small sized eggs and their live weight is lower than that of the White Leghorn. According to Scott *et al.* (1982), the net energy requirement of adult hens is $NEm = 83 \text{ kcal/kg BW}^{0.75}$. Thus for a local hen weighing 1.13 kg (overall mean), the NEm is 90.97 kcal/hen/day. Since this figure is approximately 82% of MEm value, then $90.97/0.82 = 111 \text{ kcal/hen/day}$, and adding 50% of this value for activity, the total requirement for a non laying hen without travelling energy will be 166.5 kcal/hen/day. However, in addition to that, local birds need more energy for travelling, and Bessie (1989) reported that a scavenging layer travelled about 4 km per day at an average environmental temperature of 20 deg C which implies a requirement of approximately 107 Kcal per day, giving a total requirement of 273.5 kcal/day. The mean true metabolizable energy of 286 ± 23 Kcal from calculated values is sufficient to meet calculated requirements for a non laying hen only.

Production and Productivity of Village Birds

The production level of scavenging hens is generally low, with only 40-60 small sized eggs produced per bird per year under smallholder management conditions. According to the results of Tadelles and Ogle (1996a), the total output of scavenging birds is low, not only because of low egg production, but also due to high chick mortality as half of the eggs are hatched to replace birds that have died, and the brooding time of the mother bird is long in order to compensate for its unsuccessful brooding. Smith (1990) estimates that under scavenging conditions the reproductive cycle consists of a 10 day laying phase, a 21 day incubation phase and finally a 56 day brooding period. This implies a theoretical maximum number of 4.2 clutches per hen each year, although in reality

the number is probably 2-3.

Overall the system is quite productive in relation to the very low input levels and this is underlined by McArdle (1972) who states that the net output from poultry rearing is higher in scavenging systems compared to commercial systems, and the scavenging flock is not in competition with humans for feed. This is true if we consider the input-output relation only. Chick mortality represents a major loss in scavenging village chicken production systems (Table 2), and reports from different countries show that 50-70% of chicks die between hatching and the end of brooding.

Table 2. Reported chick mortality in rural production systems in different African and Asian countries in the first 6 to 8 weeks of age.

Country	% Mortality	Reference
Sri Lanka	65	Gunaratne <i>et al.</i> (1992)
	46	Roberts (1994)
Indonesia	79	Kingston and Cresswell (1982)
	56	Hadiyanto <i>et al.</i> (1994)
Northern Ghana	80	Veluw (1987)
Ethiopia	61	Tadelle and Ogle (1996a)
Cote d'Ivoire	50	Diambra (1990)

Kingston (1980) and Kingston and Cresswell (1982) in Indonesia, Roberts (1992) in Sri Lanka and Matthewman (1977) in Nigeria calculated mortality rates of chicks as being 69%, 65% and 53%, respectively, up to 6 weeks of age. Alamargot (1987) also reports on chick mortality in Ethiopia, and during some severe epidemics, rates as high as 80% have been recorded. According to Tadelle and Ogle (1996a), the overall chick mortality was $61 \pm 17\%$ ($n=160$) in the first two months after hatching, and is higher when there was a disease outbreak in the area. Various authors attribute these losses to different causes. For example, Roberts (1992) reported that in Indonesia losses were due to a combination of poor nutrition, predators and various disease factors and,

although predators were blamed for the majority of the losses, other biological and environmental factors made significant contributions. The newly hatched chicks have access to the same feed resource base as stronger and more vigorous members of the flock but are unable to compete. In addition, the low protein and energy content of the available feed, the low hatching weight of the chicks, high ambient temperatures and other associated factors are major causes of losses, both directly, and also by increasing vulnerability to predation and susceptibility to disease.

Newcastle disease is the most important disease recognised in tropical countries in village poultry production systems (Table 3). Disease was cited as the most important problem by most of the members of the community with whom it was discussed, reducing both the number and productivity of the birds, and the problem intensified after the villagization programme in the country (1984-86). The timing of the disease outbreaks before the villagization programme was usually at the beginning of the rainy season, that is at the end of May and beginning of June, but after villagization it remains a problem throughout the year, even though it is still more serious at the beginning of the rainy season.

Sonaiya (1990), after summarising the reports from six African countries, reported that the mortality caused by Newcastle disease ranges from 50-100% per annum and that severity is higher in the dry season, whereas the disease is more widespread in the rainy season in the central highlands of Ethiopia (Tadelle and Ogle, 1996a). The farmers do not have any preventive medicine or practice for this fatal disease, and only after the start of an outbreak do they treat their birds with socially accepted medicines (Tadelle and Ogle, 1996a). However the effectiveness of these treatments is not satisfactory.

Although the local chickens are slow growing and poor layers of small sized eggs, they are however ideal mothers, good sitters and hatch their own eggs, excellent foragers, hardy and possess some degree of natural immunity against common diseases. These traits are of great importance as the farmers cannot afford to buy expensive concentrates and incubators, which at the moment are considered necessary for raising exotic birds. Brannang and Persson (1990) reported that 50% and 75% exotic blood birds did not show any signs of broodiness at the Asela

Livestock Farm. However, as reported by Panda (1987) in India, the productivity of the Kadaknath or indigenous fowl can be improved without sacrificing any of the characteristics required by village fowls. Egyptian scientists, taking a different approach, achieved significant improvements in egg production of over 21% recently by simple cross-breeding between two local strains raised in the traditional way in the near-tropical conditions of upper Egypt. This success illustrates a way of stemming the genetic erosion of local poultry breeds. Although there is a lot of evidence in the literature about genetic improvement resulting from heterosis and crossbreeding techniques with regards to egg production and growth rate, so far little research effort has been directed towards these in Ethiopia. Some information is provided by Brannang and Persson (1990), who reported average yearly egg production of 129 and 114 eggs and 48 g and 53 g mean egg weight, for birds with a 50% and 75% exotic blood levels, respectively. The only other attempt to evaluate the performance of crossbreeds with different exotic blood levels was made at Debre Zeit Agricultural Research Centre, and involved crossing local birds with White Leghorns to determine the egg production performance of the cross breeds. A preliminary analysis showed that the annual egg production of the 50% and 62.5% crosses was 146 and 193 eggs respectively (DZARC, 1991). This shows that it is possible to improve egg number and egg weight by crossing, but the results only apply to on-station conditions and no information is available for crossbred birds kept under local farmer management conditions. In any case it is not possible to substantially improve egg production if the hens incubate and rear their own chicks.

Table 3. Reported village birds mortality caused by Newcastle disease in selected African countries

Country	% Mortality	Reference
Togo	50	Aklobessi (1990)
Sudan	50	El Zubeir (1990)
Nigeria	70	Nwosu (1990) Comoros
	80	Mohammed (1990)
Ethiopia	80	Alamargot (1987)
Morocco	100	Houadfi (1990)

Conclusions

From the results of these studies it can be concluded that the scavenging system is an appropriate system for the rural areas and that it makes relatively good use of locally available resources. The requirement now is to improve these production systems in order to make the best possible use of these resources. The system is characterized by no or few inputs and a low output level. Although they appear primitive, these systems can be economically efficient because, although the output from the individual birds is low, the inputs are even lower or virtually non-existent.

The system is also characterised by huge chick mortality in the first two weeks of life, caused by different factors such as disease, predators, and the hostile environment for newly hatched chicks. The feed resource base for local birds in the villages is from scavenging and is inadequate for the production of more than around 40 eggs/birds/year. However the results from different workers show that supplementation of energy and protein in addition to other management changes can increase egg production by more than 100%.

Rural poultry production is an important part of the farming systems and needs relatively few additional resources and inputs from farmers to achieve substantial improvements in productivity and profitability by changing to semi-scavenging systems. However, because of very high mortality rates, particularly due to Newcastle disease, farmers are

generally reluctant to invest in improvements in feeding, health care and housing for example. The development of a new heat tolerant vaccine that can be administered via the feed opens up the possibility of significantly reducing mortality in village poultry, which should make producers more positive towards genetically improved birds and inputs to improve feeding and housing.

Recommendations

- Village poultry production deserves greater attention from government, research and development organizations and, above all, from rural farmers.
- Preferential access to feed by the newly hatched chicks should be given through some kind of creep feeding system.
- Strategic supplementation of both protein and energy, providing small night enclosures, regular water and disturbing the broody bird results in more than 100% increase in egg production of local birds.
- Vaccination against Newcastle disease with the new heat resistant vaccine administered via the feed will substantially reduce mortality.
- It is important to focus on working with women's groups, both to use their knowledge about poultry production and to improve their incomes.
- On-farm and on-station trials on new vaccines for the prevention of Newcastle disease are needed, particularly the heat resistant vaccine which does not need cold storage and can be administered through the feed.
- Genetic improvement should be introduced only when the current systems have been improved in terms of dietary supplementation, housing, controlling Newcastle disease and regular water and management and, in due course, to change the system to semi-scavenging.

References

- Adene, D. F., 1990. The management and health problems of rural poultry stock in Nigeria. CTA-Seminar proceedings on smallholder rural poultry production. 9-13 October 1990, Thessloniki, Greece, 2:175-182.
- Agbede, G., Demey, F., Verhuls A. T., Bell, J. G., 1990. The impact of Newcastle disease in the traditional chicken farms of Cameroon. CTA-Seminar proceedings on smallholder rural poultry production. 9-13 October 1990, Thessloniki, Greece, 2: 49-54.
- Aini, I., 1990. Indigenous chicken production in South East Asia. *World's Poultry Sci. Journal*, 46:51-56.
- Aklobessi, K. K., 1990. Smallholder Rural Poultry production in Togo. CTA-Seminar proceedings on smallholder rural poultry production. 9-13 October 1990, Thessloniki, Greece, 2: 37-42.
- Alamargot, J., 1987. Avian pathology of industrial poultry farms in Ethiopia. Proceedings of the First National Livestock Improvements Conference 11-13 February 1987, Addis Abeba, Ethiopia, pp 114-117.
- Alemu, S., 1987. Small scale poultry production. Proceedings of the First National Livestock Improvements Conference 11-13 February 1987, Addis Abeba, Ethiopia, pp 100-101.
- Alemu, Y., 1995. Poultry production in Ethiopia. *World's Poultry Science Journal*, 51: pp 197-201.
- Andrews, P., 1990. Rural poultry development in The Gambia. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: pp 81-85.
- Australian Agricultural Consulting and Management Company (AACMC), 1984. Livestock sub sector review, Volume 1, Annex 3.
- Bessei, W., 1990. Experiences with rural poultry development projects. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: pp 53-60.
- Bigbee, D. G., 1965. The management of the native chickens of Ethiopia. Miscellaneous publication, No. 5. HSIU, College of Agriculture, Alemaya.

- Brannang, E. and Persson, S., 1990. Ethiopian Animal husbandry, Uppsala, Sweden, 127 pp.
- Cumming, R.B., 1992. Village chicken production: Problems and potential. Spradbrow, P. B. (Editor) Proceedings of an International Workshop on Newcastle disease in village chickens, control with Thermostable Oral Vaccines 6-10 October, 1991, Kuala Lumpur, Malaysia, pp 21-24.
- Debre Zeit Agricultural Research Centre (DZARC), 1991. Annual Research Report 1990/1991. Debre Zeit, Ethiopia.
- Diambra, O. H., 1990. State of Smallholder Rural Poultry production in Cote d'Ivoire. CTA- Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: pp 107-116.
- El Zubeir, A., 1990. Smallholder Rural Poultry production in the Sudan. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: pp 217-226.
- Ethiopian Mapping Agency (EMA), 1981. National atlas of Ethiopia, Addis Abeba, Ethiopia.
- Feltwell, R. and Fox, S., 1978. Practical poultry feeding, Faber and Faber limited, Great Britain, pp 36-59.
- Gunaratne, S. P., Chandrasiri, A. D., Mangalika Hemalatha W. A. P., and Roberts, J. A. , 1992. The Productivity and Nutrition of Village Chickens in Sri Lanka. Spradbrow, P. B. (Editor) Proceedings of an International Workshop on Newcastle disease in village chickens, control with Thermostable Oral Vaccines 6-10 October, 1991, Kuala Lumpur, Malaysia, pp 21-24.
- Harris, L. E., 1966. Biological energy interrelationships and glossary of energy terms. Publ. 1411, National Academy of Sciences-National Research Council, Washington, D.C.
- Houadfi, EL. M., 1990. Rapport sur la production avicole et problemes lies aux elevages traditionnels au Marco. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: pp 161-171.

- Huchzermeyer, F. W., 1967. Some thoughts on poultry keeping in African areas of Rhodesia under subsistence economy conditions. *Rhodesian Agriculture Journal*, 64: 133-139.
- Huque, Q.M.E. and M.J.Hossain.1991. Production potentials of ducks under scavenging system of management. *Bangladesh Journal of Animal Sci.*, 20(1&3):119-122.
- International Livestock Centre for Africa (ILCA), 1983. Research on farm and livestock productivity in the central Ethiopian highlands: Initial results, 1977-1980. ILCA research report, No. 4, Addis Abeba, Ethiopia.
- International Livestock Centre for Africa (ILCA), 1993. Handbook of African Livestock Statistics. ILCA, Addis Abeba, Ethiopia
- Islam, M.K., Hussain, M.A., Haque, M.F. and Paul, D.C., 1992. Performance of Fayomi Poultry Breed with Supplemental Ration Under Farmers' Management. Abidur, R., (Editor) Proceedings of the Fourth National Conference of Bangladesh Animal Husbandry Association, December 26 - 27, 1992.
- Kassimo, M., 1990. Rapport sur L'Operation coqs raceurs a' anjouan Comores. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessloniki, Greece, 2: 55-65.
- Kidane, H., 1980. Performance of F1 Crossbred Birds. Wollaita Agricultural Development unit. Animal Husbandry and Breeding. Wollaita Sodo, Ethiopia Bulletin No. 4: 38 pp.
- Kingston, D. J., 1980. The productivity of scavenging chicken in some villages of West Java, Indonesia. Proceedings 1980 South Pacific Poultry Science Convention. 13-16 October 1980 Auckland, New Zealand, pp 228-237.
- Kingston, D. J., and Creswell, D. C., 1982. Indigenous chickens in Indonesia: population and production characteristics in five villages in West Java. Bogor, Indonesia, Research Institute for Animal Production, Report No. 2: 3-8.
- Kulube, K., 1990. Small holder rural poultry production in Zimbabwe. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: 263-270.

- Matthewman, R., 1977. A survey of small livestock production at village level in the derived savanna and lowland forest zones of South West Nigeria (Monograph, Univ. of Reading, 1977)
- Mbugua, N. P., 1990. Rural smallholder poultry production in Kenya. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: 119-131
- McArdle, A.A., 1972. Methods of poultry production in developing area. *World Animal Review*. 2: 28-32.
- Ministry of Agriculture (MOA), 1980. Development Strategy of Animal Breeding and Improvement: 10 year Development Strategy. Animal Breeding and Improvement Team, MOA, Addis Abeba, Ethiopia.
- Nesheim, M. C., 1986. Austic, R. E., and Card, L. E., 1979. Poultry production. 57 pp.
- Nwosu, C. C., 1990 The state of small holder rural poultry production in Nigeria. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2:183-194.
- Panda, B., 1987. Role of poultry in socio-economic development of small farmers in India. *Asian Livestock*, 12: pp 145-148.
- Roberts, J.A., 1992. The scavenging feed resource base in assessments of the productivity of scavenging village chickens. Spradbrow, P. B. (Editor) Proceedings of an International Workshop on Newcastle disease in village chickens, control with Thermostable Oral Vaccines 6-10 October, 1991, Kuala Lumpur, Malaysia, 29-32.
- Savory, C.J., 1989. The importance of invertebrate food to chicks of gallinaceous species. *Proceeding of Nutrition Society No. 48*: 113-133.
- Sazzad, M.H., 1986. Reproductive performance of Desi hens under scavenging and intensive systems of rearing. Proceedings of first Annual Livestock Research Workshop, Livestock Research Institute, Savar, Bangladesh.
- Sazzad, M.H., S.M.H. Mamotazul and A.U. Asaduzzamn, 1988. Growth pattern of Desi and Khaki Campbell ducks under rural condition. *Indian Journal of Poultry Sci.* 23(2):165-166.
- Scott, M. L., Nesheim M. C. and Young, R. J., 1982. Nutrition of the chicken. pp 48-92.

- Smith, A. J., 1990a. Poultry-Tropical Agriculturist series. CTA, Macmillan Publishers, London. pp 179-184.
- Smith, A. J., 1990b. The integration of rural production into the family food supply system. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 1: 15-128.
- Sonaiya, E. B., 1990 The context and prospects for development of smallholder rural poultry production in Africa. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 1: 35-52.
- Tadelle, D. and Ogle, B. 1996a. A survey of village poultry production in the central highlands of Ethiopia. M.Sc Thesis, Swedish University of Agricultural Sciences, pp 22.
- Tadelle, D. and Ogle, B. 1996b. Nutritional status of village poultry in the central highlands of Ethiopia as assessed by analyses of crop contents and carcass measurements. M.Sc Thesis, Swedish University of Agricultural Sciences, pp 15.
- Tadelle, D. and Ogle, B. 1996c. Effect of maize (*Zea mays*) and noug (*Guizotia abyssinica*) cake supplementation on egg production performance of local birds under scavenging conditions in the central highlands of Ethiopia. M.Sc Thesis, Swedish University of Agricultural Sciences, pp 14.
- Teketel, F., 1986. Studies on the meat production potential of some local strains of chickens in Ethiopia. PhD Thesis, J.L. University of Giessen, pp 210.
- Upindi, B. G., 1990. Smallholder Rural Poultry production in Malawi. CTA-Seminar proceedings on smallholder rural poultry production 9-13 October 1990, Thessaloniki, Greece, 2: 141-146.
- UNDP/FAO. 1983. Rural poultry improvement project of the Govt. of the People's Republic of Bangladesh. No. BGD/82/003. Project document, Dhaka, Bangladesh.
- Veluw, V. K., 1987. Traditional poultry keeping in Northern Ghana. ILEIA, 3(4): 12-13.