Regional report

Village egg and fowl meat production in Africa

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Throughout the continent of Africa the keeping of indigenous fowl by village communities has been practised for many generations. These birds, which are generally kept on a free range system, currently make up more than 80% of the continent's poultry flock. Although requiring minimal resource input and considered secondary to other agricultural activities by farmers, this type of production has an important role in supplying local populations with additional income and high quality protein. However, high mortality, especially in growers, constitutes the greatest constraint on development. Indigenous fowl are not a particular variety but are the result of erratic crosses between local and imported stocks. Growth and egg production of the indigenous birds are low and their limits of performance are rapidly reached when feeding and management are improved. However, the meat and eggs are much preferred by the consumers and fetch premium prices compared with commercial birds. The genetic potential of the indigenous stocks could be improved through crossing with selected but still robust varieties.

Keywords: Africa, eggs, meat, mortality, Newcastle disease, production, village fowl

Introduction

African livestock population statistics for 1995 indicate poultry to be the most numerous species of farm animal (Anonymous, 1996a). More than 80% of poultry are kept in rural areas and contribute substantially to annual egg and meat production (Sonaiya, 1997). Throughout Africa poultry production stems from ancient traditional practices. Domestic fowl are the most important type of poultry kept on the continent. In general, village producers keep small flocks of between 5 and 20 birds per household (Guèye, 1997a). Women and children play a key role in their management (Kitalyi, 1996; Guèye, 1997a). The fowl are generally raised on a free range system and they survive as scavengers. Rudimentary coops or shelters may be provided to give some protection against bad weather and night predators such as reptiles. Thus,

village fowl in Africa are maintained with very low land, labour and capital inputs and can therefore be kept by even the poorest social strata of the rural population.

Because of low productivity, indigenous fowl production in Africa has been neglected and is frequently considered by farmers as an insignificant occupation compared with other agricultural activities. Nevertheless, outside urban centres, and especially in non-coastal areas, village fowl provide the population with a vital source of protein and income. In addition, they play ***an*** important role within the context of many social and/or religious ceremonies. This paper reviews the most relevant information available in Africa relating to the traditional extensive husbandry system of fowl production.

Socioeconomic and nutritional importance

The human population in Africa is estimated to be 728 million (Anonymous, 1996b), while the total fowl popuïation of the continent was estimated as 1068 million in 1995 (Anonymous, 1996a), producing 1695 620 metric tons of eggs and 2096000 metric tons of meat (Anonymous, 1996b). Domestic fowl are kept by almost every village household. Because most reports underestimate the true numbers, village fowl probably make up more than 80% of the total fowl population *(Table* 2). This is in line with the findings of Sonaiya (1995) who reported the same proportion. Moreover, in some African countries (*Table 1*) the ratio of village fowl to village human population is about 1.5. Thus, there are approximately three fowl for every two people.

Table 1 Estimated populations of village fowl in some African countries, their contribution to the national flocks and the ratio of village fowl population to village human population

Country	Village fowl population (millions)	Village fowl as a percentage of the national flock	Ratio of village fowl population to village human population	Reference
Cameroon	11.2	70	1.57†	Ngou Ngoupayou (1995)
Central African Republic	2.2	80	1.06†	Anonymous (1997)
Ivory Coast	15.4	73	2.44†	Diambra (1990)
Ethiopia	55.9	99	1.22†	Yami (1995)
Gambia	0.9*	90	1.32	Andrews (1990)
Kenya	16.1	70	0.84	Musiime (1992a)
Lesotho	1.6		1.12†	Khomari (1992)
Malawi	12.0	90	1.46†	Upindi (1990)
Mali	18.0	90	2.50†	Kounta (1992)
Nigeria	123.9	93	2.59†	Ologhobo (1992)
Senegal	11.1	70	2.22†	Guèye (1997b)
Sudan	21.0	70	1.09	El Zubeir (1990)
Tanzania	21.0	75	1.14	Kabatange and Katule (1989)
Togo	3.9	70	1.55	Lobi (1984)
Uganda	16.0	80	1.01†	Mukiibi-Muka (1992)
Zimbabwe	8.9-10.7	25-30	1.41†	Kulube (1990)

*Calculated from data of the year 1995 (Anonymous, 1996a).
†Author's estimate.

In general, in rural areas throughout the African continent all ethnic groups are involved in poultry production. In addition to providing farmers with eggs and meat for their home consumption, poultry are kept for a variety of other reasons. The sale (or barter) of poultry products enables poultry keepers to obtain money to spend on their own and family needs. In the context of intra- and inter-community exchanges, indigenous fowl have a symbolic importance within many social activities (e.g. special banquets for distinguished guests, gifts) and/or religious ceremonies (e.g. cocks as offerings to the deities) (Veluw, 1987; Lul, 1990; Okot, 1990; Sonaiya, 1990a, 1990b; Williams, 1990; Kounta, 1991; Buldgen et *al.*, 1992; Zoungrana and Slenders, 1992; Spradbrow, 1993/94; Bell and Abdou, 1995; Guèye and Bessei, 1995; Yami, 1995). In the Western Middle-Belt region of Nigeria, Atteh (1989) reported the reasons for keeping village fowls as being 11% for income alone, 28% for consumption alone, 45% for income and consumption, 3% for ceremonies, 11% for income and ceremonies, 3% for consumption and ceremonies and 1% for ornament. In the Keita region of Niger home consumption accounted for 47%, sales for 38% and gifts for 16% (Bell and Abdou, 1995). When the traditional society of the Mamprusi tribe in Northern Ghana is considered, Veluw (1987) reported that the uses of poultry were 35% for sacrifice, 28% for sale, 15% for consumption, 13% for gifts and 10% for breeding stock, while 71% of the eggs were set aside for hatching, 18% for sale, 5% for consumption and 5% for gifts. Additionally, indigenous fowl play an important role in traditional medicine (Lul, 1990; Ngou Ngoupayou, 1990, 1995).

Flock sizes for a number of African countries are shown in Table 2. It can be seen that relatively larger flock sizes are reported from Madagascar and Mali. In the latter country the survey was carried out in areas where farmers benefit from the effects of a development project ('Projet Sectoriel de l'Elevage'). Furthermore, flock sizes can vary depending on factors such as the season in which the survey is carried out and the occurrence of diseases. Guèye (1997a) reported that flock sizes generally range from 5 to 20 fowl per African village household.

Table 2 Estimated numbers of domestic fowl per village household in various countries

Country	Number	Source
Benin	7-12	Assan (1990)
Cameroon	10.3	Ngou Ngoupayou (1990)
Congo	19	Nkodia (1990)
Ethiopia	6	Yami (1995)
Kenya	7-14	Mbugua (1990)
Madagascar	20-50	Raveloson (1990)
Mali	20-30	Kounta (1991)
Morocco	2-40	El Houadfi (1990)
Niger	12	Bell and Abdou (1995)
Nigeria	14.1	Sonaiya (1990a)
Senegal	10	Sall (1990)
Somalia	5-15	Lul (1990)
Sudan	5–10	El Zubeir (1990)
Tanzania	12	Kabatange and Katule (1989)
Togo	21	Aklobessi (1990)
Uganda	2-20	Okot (1990)
Zimbabwe	20-25	Kulube (1990)

The male to female ratios in village fowl flocks in Africa were found to be 3.5:1 in Central Mali (Kuit et *al.*, 1986), 4.9:1 in the Thiès and Fatick regions of Senegal (Sall, 1990), 2.3:1 in the Ivory Coast (Diambra, 1990), 3.1:1 in Niger (Bell and Abdou, 1995), 1.9:1 in South Western Nigeria (Sonaiya and Olori, 1989) and 1.4:1 in the Central River Division of Gambia (Bonfoh, 1997). The numbers of males tend to be lower in flocks with high proportions of growers, and to be higher in larger flocks. Males are generally removed from the flocks at an early age for sale, home consumption or cultural purposes.

The information available in the literature about the ownership patterns of village fowl indicates that women, assisted in some cases by children, are the main keepers. According to Atteh (1989), village fowl kept in Nigeria are largely owned by women (86%) compared with 14% by men. Comparable figures were also reported for Nigeria (78% versus 22%) by Sonaiya and Olori (1989). The ownership pattern of village fowl in the Gambia was found to be 47% by women, 38% by the whole family, 12% by men and 3% by women and children (Bonfoh, 1997). Savané (1996) reported that, in the Kolda region of Senegal, about 54% and 46% of the poultry owners were women and men, respectively. By contrast, according to Bell and Abdou (1995), about 83% and 17% of fowl in Niger are owned by men and women, respectively. These data patterns generally underestimate the proportion owned by women (and thus overestimate that by men) because, in most cases, only men could be interviewed. This is a consequence of the dominating position held by men in most African societies. General statements on ownership can also be misleading because there are different modes of acquisition of domestic fowl (e.g. purchase or barter, gifts or inheritance).

In spite of the small numbers of fowl kept by village farmers, the contribution of this sector to national egg and meat production is substantial. Village poultry were estimated to account for 12.4% of the estimated 192 640 metric tons of eggs produced in Nigeria in 1987 (Sonaiya, 1997). In Côte d'Ivoire the village poultry population provided about 69% of the 21500 metric tons of poultry meat and 26% of the 12200 metric tons of eggs produced in 1984 (Diambra, 1990). In Morocco about 26% of the 117000 metric tons of poultry meat and 36% of the 1100 million eggs produced in 1989 came from indigenous fowl (El Houadfi, 1990). In reality these proportions are probably higher at present because commercial producers have to cope with various supply bottlenecks due to their high dependence on imports (which need hard currencies) and because of periodic shortages of feed and other inputs (Ngou Ngoupayou, 1990; Guèye, 1997c).

Compared with eggs and fowl meat from commercial flocks derived from imported stocks, those from indigenous stocks are strongly preferred by African consumers (Adebanjo and Oluyemi, 1981; Horst, 1989; Oluyemi, 1989; Mbugua, 1990; Ngou Ngoupayou, 1990; Raveloson, 1990; Guèye and Bessei, 1996, 1997). They therefore fetch premium prices. For example, the average indigenous fowl meat prices in 1995 in Dakar, Senegal varied from US$2.54 to US$3.93 per kg at markets and supermarkets, respectively. These amounted to premiums of about 13% at markets and 27% at supermarkets in comparison with the prices of meat from commercial fowl. Thus, well-off people in supermarkets appear willing to pay more in order to get indigenous fowl meat. However, in Nigeria the prices from itinerant retailers for local and exotic growers were the same, while market prices for male birds were two to three times higher than for females, i.e. US$4.08–5.10 for mature males and US$1.63–2.04 for mature females (Sonaiya *et al.*, 1992). There is a dearth of information on comparative egg prices.

Table 3 Productive traits of local breeds and of improved crossbreeds in Egypt

Breeds	Origin	Productive traits			
		Number of eggs	Egg weight (g)	Mature male weight (g)	Mature female weight (g)
Fayomi	Local breed	160	42	1950	1650
Dandarawi	Local breed	153	48	1950	1780
Dokki 4	Fayomi x Plymouth	167	50	2460	1780
Matrouh	Dokki x Leghorn	192	57	2380	1700
Golden montazah	Dokki × Rhode Island Red	199	55	2700	2000
Silver montazah	Dokki x Rhode Island Red	205	54	2500	1890
Mamoura	Dokki x Iskandrani	185	55	3120	2430
Mandarah	Dokki x Iskandrani	180	57	2800	2150
Gemeza	Dokki x Plymouth White	180	57	2800	2150
Elsalam	Manoura x Nichols	175	58	3520	2630
Bandarah	Gemeza x Cornish White	180	65	3500	2800

Source: Zaza (1992)

'Breeds'

The domestic fowl (*Gallus gallus*), reared in African rural areas, has been described by many authors (Anonymous, 1987; Oluyemi, 1989; Aklobessi, 1990; Lul, 1990; Raveloson, 1990; Sonaiya, 1990b; Buldgen *et al.*,1992; Guèye and Bessei, 1996). Various workers use common terms such as 'African chicken', 'bush chicken' **or** 'runner chicken' to describe the indigenous fowl (Berte, 1987; Kounta, 1991; Guèye and Bessei, 1997). However, distinct local varieties are reported from some African countries. In Sudan there are 'Baladi' which are characterized by large body weight at 12 months (i.e. 1.37 kg for the female and 1.88 kg for the male), have a wide range of feather colours and a small 'crushed' comb, 'Bare Neck chicken' with featherless neck and small body weight of 1.1 kg at maturity and the layer strain 'Betwil' which produces 70-80 40g eggs per year under the traditional husbandry system (Musharaf, 1989). The Moroccan 'Beldi' shows great ability to convert unconventional feedstuffs into meat (El Houadfi, 1990). Ngou Ngoupayou (1990) reported on the indigenous fowl in Cameroon which include 'Dzaye' with white feathers, 'Dongwe' with black feathers, the meat-type 'Tsabatha' with mixed coloured feathers (grey, black and white) and a layer strain called 'Zarwa'. In Egypt Zaza (1992) reported on the productive traits of two local breeds – the 'Fayomi' and the 'Dandarawi' (Table 3). According to Berte (1987), two local breeds are mainly used by farmers in Burkina Faso – the 'African chicken' and the 'Kondé chicken' (which probably originated from Zabré and Tenkodogo in Burkina Faso, the Atacora region in Benin and the Tchaoudja in Togo). Three local strains of 'African chicken' are described in Burkina Faso: the 'Fulani chicken' with white feathers resembling the Leghorn, the 'Djeligodji chicken' or 'Dori chicken' with multicoloured feathers (grey, tawny or black) and the 'chicken of the centre' or 'grey chicken' which is the most widespread strain with local names in different languages (i.e. 'kolocissai' in Dioula and 'no liguidi' in mooré). The 'Kondé chicken' is a squat bird (1.8 kg live weight) with robust legs, ash grey feathers, a well developed simple comb and vividly orange-

coloured eyes. In reality, it is not irrefutable that these names represent true 'breeds', except for Egypt. It is therefore necessary to determine whether or not these names are merely phenotypic descriptions since Kassambara (1989) described 15 'breeds' of indigenous fowl in Mali based entirely on feather colour. In the whole African continent local stocks are descended from disorderly crossings of local and exotic strains. There is no systematic breeding system. The concept of 'breed' is therefore not correct.

Indigenous fowl tend to be very robust and are well adapted to harsh environmental conditions such as hot or cold weather, rain and periodic feed shortages. Plumage colours of the indigenous fowl vary from simple colours (e.g. white, black, red) to all possible combinations including gold, silver, fawn and mottling. A survey of 275 village farmers in Nigeria (Sonaiya and Olori, 1989; Sonaiya, 1990a) revealed that 75% of fowl showed smooth and multicoloured feathers, 12% had frizzled feathers, 6% were naked neck fowl and 4% were dwarf fowl. According to farmers, multi-colours serve as a camouflage for the young chicks against aerial predators such as hawks and kites which easily pick out simple colours, especially white. Furthermore, white fowl are more likely to be thieved because such birds are embedded in the folklore of many human groups.

Management systems

The types of husbandry mostly practised for village fowl production in Africa are the free range and backyard systems. The free range system, which in some cases is known as 'traditional' or 'village' system (Andrews, 1990; El Houadfi, 1990) is the most popular in rural areas (Veluw, 1987; Kabatange and Katule, 1989; Kassambara, 1989; Musharaf, 1989; Assan, 1990; Lul, 1990; Kulube, 1990; Mbugua, 1990; Okot, 1990; Raveloson, 1990; Sonaiya, 1990a; Williams, 1990; Sonaiya ef *al.*, 1992; Guèye and Bessei, 1996; Guèye, 1997a). Indigenous fowl are left to scavenge around household compounds, feeding on available resources such as earthworms, household refuse, insects, residues from the harvest, etc. Generally their feed is not supplemented with agricultural (by-) products apart from during periods of food scarcity (Guèye, 1997a). There is also no clean water. Because of the absence of shelter, birds perch on high places or they shelter in human habitations (Sall, 1990) or in the kitchens (Ngou Ngoupayou, 1990; Okot, 1990). However, this often causes problems **when** fowl are infested with external parasites. In some cases **the** fowl are sheltered at night time in rudimentary coops, often raised above the ground, which provide protection against bad weather and night-time predators such as reptiles.

The backyard system, which is called the 'family' or 'subsistence' system (Berte, 1987; Nkodia, 1990; Aklobessi, 1990), is practised by some farmers (Upindi, 1990; Zoungrana and Slenders, 1992). In the backyard system birds spend the night in constructed shelters with water and supplementary grain generally being provided. In both systems birds almost never receive veterinary care.

Because village fowl are maintained with very low levels of input (land, labour and capital), they can be kept by those in the poorest social strata of rural populations. However, because of the low productivity, indigenous fowl production in most African countries has been denigrated or **even** ridiculed and it is frequently considered by farmers as an insignificant secondary occupation when compared with other agricultural activities. Nevertheless, the sustainahility of this type of production system under the harsh village conditions **has** been largely demonstrated (Bessei, 1996).

In most African countries women (El Houadfi, 1990; Scola, 1992) and children (Veluw, 1987; Musharaf, 1989; Lul, 1990; Kitalyi, 1996; Bonfoh, 1997; Guèye, 1997a) play the key role in flock management. There is a tendency for management to be better in the case of larger flocks. In Egypt married women keep larger flocks of village fowl than widows (Aboul-Ella, 1992).

Common diseases and mortality

One of the major constraints to village fowl production in Africa is undoubtedly the existence of various diseases. According to the accounts of poultry farmers in the Gambia reported by Bonfoh (1997), the most prevalent diseases are Newcastle disease (88%), fowl pox (6%), fowl cholera (3%) and coccidiosis (3%). In Nigeria farmers mentioned Newcastle disease (61%), respiratory diseases (14%), fowl pox (7%), pullorum/diarrhoea (7%) and fowl cholera (4%) as affecting their chicken flocks (Atteh, 1989). These farmers' findings have been confirmed by laboratory investigations, demonstrating that village farmers tend to be good poultry specialists. Thus, Sa'idu et *al.* (1994), in a 15 year laboratory study of indigenous fowl in Nigeria (October 1976–1991), showed that the commonest and most significant causes of mortality were Newcastle disease (41%), infectious bursal diseases (19%), fowl pox (19%), ectoparasitism e.g. lice and mites (27%), and endoparasitism e.g. *Tetrameres* sp., *Syngamus* sp. and tapeworms (31%). There were also various parasitic associations in village fowl.

In many African countries Newcastle disease is the most serious endemic disease (Bell, 1990; Demey, 1990; Mussime, 1992b; Spradbrow, 1993/94; Bell, 1996; Verwoerd, 1996) which devastates village poultry population in periodical outbreaks. Sonaiya et *al.* (1992) reported that major outbreaks of Newcastle disease regularly occur at the peak of rains (June/July) when it is wet and cold. However, according to village farmers in Senegal outbreaks occur generally during the dry season, from January to June, and the affected birds show neurological symptoms which manifest in strangely 'mad' behaviour. There is a belief that bad spirits that originally have the family as a target are diverted to the birds. This partially explains why in most Senegalese village households there is a fowl flock.

Rearing losses are severe, with high mortality in young chicks being an important component. It is estimated that mortality of indigenous fowl under traditional management systems is 50% up to eight weeks of age in Burkina Faso (Wilson, 1986) and Northern Ghana (Veluw, 1987), 66% by 12 weeks of age in Senegal (Sall, 1990; Buldgen *et al.*, 1992), 30–50% up to four weeks of age in Mali (Kounta, 1992), 68% up to six weeks in Nigeria (Ologhobo, 1992), and 53% up to four weeks of age in Cameroon (Agbédé et *al.*, 1995). These high cumulative levels of mortality influence the structure of the flocks. Thus, the numbers of chicks in village fowl flocks are very high. In the Thiès and Fatick regions of Senegal about half the village fowl are less than one month old (Buldgen et *al.*, 1992). In Niger chicks constitute about 33% of the fowl flocks (Bell and Abdou, 1995) and in the Gambia about 65% of the fowl flocks are chicks (Bonfoh, 1997).

Control of Newcastle disease

Village fowl are almost never vaccinated against Newcastle disease with Western standard vaccines. In the Gambia one of the preventive measures ('vaccination') traditionally used by farmers consists of blending excreta of any wild birds with goat's milk and giving the resulting mixture as a drink (Bonfoh,

1997). Wild birds are considered by farmers as reservoirs of Newcastle disease virus. The findings of these farmers have been confirmed by Martin (1992) who reported that velogenic, mesogenic and lentogenic strains of Newcastle disease virus had been isolated from numerous species of wild birds all over the world, and that **they** form a reservoir for the virus. In addition, some farmers were found to use the entrails of fowl that had died from Newcastle disease to treat their birds against this disease. The entrails are soaked in goat's milk before being given to the birds (Bonfoh, persona1 communication). The use of the milk is scientifically well founded since it serves generally as a stabilizer for inactivated viruses in vaccine preparations.

A variety of ethno-veterinary practices is widely used by farmers in Africa in order to control Newcastle disease in village fowl. Plant products with recognized medicinal properties are generally involved. In the absence of severe droughts as, for example, **those** that occurred in the 1970s and 1980s in Sahelian countries, **they** are far more accessible to villagers than the drugs used in Western veterinary treatments because they can be collected at no cost or are cheap to obtain (Guèye, 1997a). Thus, the bark of *Parkia filicoidea* in Nigeria, the leaves of *Cassia didymobotrya* or the latex of *Euphorbia mafabelensis* in Zimbabwe, the stem of *Euphorbia candelabrum Kofschy var. candelabrum* or the fruit of *Capsicum annuum* together with the leaves of *lboza multiflora* in Tanzania are put into drinking water for the whole flock (Bizimana, 1994). In Senegal **the** bark of *Khaya senegalensis* and *Capsicum* sp. extracts are soaked in drinking water (field observations) and the bark of *Mangifera indica* in drinking water is used in the Gambia (Bonfoh, 1997). Moreover, in addition to Newcastle disease, *Capsicum* spp. are reported to be widely used to treat various unknown diseases (Kassambara, 1989; Assan, 1990; Nkodia, 1990; Okot, 1990; Sonaiya et *al.*, 1992; Bonfoh, 1997; Guèye, 1997a). The suggestion is that capsaicin, **the** pungent agent in *Capsicum* spp., increases the resistance of birds to major health threats.

Growth, egg production and reproductive performance

Indigenous fowl are used for the production of both meat and eggs. They grow very slowly and are rather small, with the adult females weighing about 1 kg and adult males seldom more **than** 2 kg *(Table* 4). However, 'Kondé chicken' in Burkina Faso (Berte, 1987), 'Baladi' in Sudan (Musharaf, 1989) and 'Tsabatha' in Cameroon (Ngou Ngoupayou, 1990) are characterized by larger body weights and these varieties show potential to be used as meat-type fowl.

The eviscerated carcass yield of indigenous fowl **has** been estimated to be 64% in mature males and 54% in mature females in Nigeria (Joseph et *al.*, 1992) and 79% in males and 67% in females at 25 weeks in Senegal (Buldgen et *al.*, 1992). Indigenous fowl **have** small but well-fleshed and compact bodies. While the percentage water and fat contents of carcasses do not appear to vary from 4 to 64 weeks of age in males, the indigenous fowl in Nigeria show increasing protein contents, from 46% at 4 weeks to 66% at 64 weeks of age (Adebanjo and Oluyemi, 1981). Cnrcass composition is also affected by sex. In one study, working on a dry weight basis, Joseph *et al.* (1992) found the meat of females to contain 20% fat compared with 17% in males. This, in turn, affected crude protein **content** (77.8% versus 74.8%) and ash content (3.9% versus 3.7%) in males and females, respectively.

Village fowl are characterized by their late maturity. Sexual maturity of females is estimated to be 32 weeks in Sudan (Wilson, 1979), 24 weeks in Mali (Kassambara, 1989) and Nigeria (Sonaiya and Olori, 1989), 28-36 weeks in Benin

Table 4 Production parameters of village fowl in Africa

Country	Eggs/ clutch	Clutches/ year	Egg production (eggs/hen/year)	Egg weight (g)	Hatchability (%)	Mature weight (kg) Males	Mature weight (kg) Females	Reference
Benin		-	50-100	40	-	1.2-1 .8	0.7-1.2	Assan (1990)
Burkina Faso	12-18	2.7-3.0		30-40	60-90	-	-	Bourzat and Saunders (1989)
Cameroon		-	50-80	30	82	2.5	1.3-1 .8	Ngou Ngoupayou (1990)
Ghana		2.5	20		72	-	-	Veluw (1987)
Mali	8.8	2.1	35	34.4	69.1	1.6	1.02	Wilson et *al.* (1987)
Morocco	12-20	-	60-80	35-50	70	1.2	1.2	El Houadfi (1990)
Nigeria	10	2-3	-	-	80	-		Sonaiya (1990a)
Senegal	8-15	4-5	40-50	40	80	1.8	1.2	Sall **(1990)**
Sudan	10.9	4.5	50	40.6	90	2.1	1.3	Wilson (1979)
Tanzania	12-13	3	36	37.9-49.5	-	1.2-2.9	1 .o-2.1	Katule (1992)

-, not reported.

(Assan, 1990), 25 weeks in Senegal (Sall, 1990) and 28 weeks in Tanzania (Katule, 1992). However, by the improvement of feeding and husbandry systems, sexual maturity may be earlier, i.e. from 25 to 20 weeks (Table 5). Genetic upgrading through crossing with exotic stocks may also bring sexual maturity forward from 28-36 weeks to 18-20 weeks (Assan, 1990).

Egg production of indigenous fowl is very low. Under village conditions the annual egg production per bird ranges from 20 to 100 eggs with an average weight ranging from about 30 to 50g (*Table 4*). Egg production in rural areas follows a pattern of 8–10 week periods of production with intervening periods of broodiness. The process of maturation of the ovum has been reported to take 10-15 days (Sall, 1990), 15 days (Savané, 1996) in Senegal, and 16 days (Katule, 1992) in Tanzania. These contribute to rates of oviposition of two eggs in three days or one egg in two days. In practice, annual egg production exceeding 80 eggs is seldom achieved under extensive conditions. However, with improved feeding and husbandry performances have been reported of 90–100 eggs in Senegal (Sall, 1990; Buldgen *et al.*, 1992), 100 eggs in Cameroon (Ngou Ngoupayou, 1990) and over 150 eggs per bird in Tanzania (Kabatange and Katule, 1989). The frequency of egg collection plays an important role in determining egg production. Daily collection of eggs postpones broodiness and thus leads to higher egg production (Guèye and Bessei, 1997).

Few of the eggs of village fowl are consumed, most are allowed to incubate under the mother hen because farmers in Africa are aware of high mortality, especially in growing birds. In most cases keeping at least a small flock is the major concern. Indigenous stocks tend to have good mothering ability. The hatchability of eggs is estimated to be more than 70% (*Table* 4) and is correlated with the male/female ratio ($r = -0.67$, $p < 0.05$). According to Wilson et *al.* (1987) and Kassambara (1989), hatchability is seasonally affected with the poorest results occurring during the hot dry season. Farmers in Senegal claim that indigenous birds with the naked neck gene (Na) show particularly good brooding abilities.

Table 5 Reproductive parameters of the Senegalese indigenous fowl in a rural environment and an experimental station with and without use of an additional artificial lighting programme (LP), respectively

	Rural environment	Experimental station	
		With LP	Without LP
Age at sexual maturity (weeks)	2.5	20	20
Mean (SD) egg yield (%)	12	24 (13)*	26 (17)†
Mean (SD) egg weight (g)	40 (4)	44 (1)	40 (4)
Total egg production per annum	40–50	80-90	90-I 00
Mean (SD) feed intake (g/day/bird)		102 (14)	78 (17)
Cumulative feed conversion+		13	27
Fertility (%)		81	
Hatchability of fertile eggs (%)	80	77	

Source: Buldgen et *al.* (1992).
*In 30 laying weeks.
†In 42 laying weeks.
‡During 30 and 42 laying weeks, respectively.

Genetic improvement

In addition to the major impact of environmental factors, the considerable variation in performance parameters of village fowl in Africa is also obviously affected by genetic components. Much variation has developed as a result of random breeding within, and sometimes between, diverse populations (El Houadfi, 1990; Sonaiya et *al.*, 1992; Guèye and Bessei, 1995). Such birds can be improved genetically through selective breeding or by crossing with exotic stocks. Exotic breeds characterized by high productivity and hardiness such as Rhode Island Red, New Hampshire and Plymouth Rock are generally used (Anonymous, 1987). For example, Zaza (1992) reported on the higher egg and meat production obtained in Egypt from improved crossbreeds compared with local breeds (*Table* 3). However, this must not lead to the indigenous stocks being neglected. They should be protected for two main reasons. Firstly, indigenous fowl represent an important reservoir of genetic variation that should be conserved. Secondly, these birds are well adapted to extensive husbandry systems and are utterly suitable for poultry farmers endowed with very limited means, as is so often the case in African rural areas.

Conclusions

In Africa the indigenous fowl are known to have some disadvantages arising from their slow growth and poor egg production, their late sexual maturity and the fact that they suffer high rearing mortality. However, the production of these birds is characterized by many advantages such as good egg and meat flavour, hard egg shells, high dressing percentages, and especially low cost with little special care required for production. They are therefore well suited to the very limited input that the mainly poor producers can provide. However, efforts to increase productivity through improvements in health, feeding, housing, genetics and daily management should be encouraged as they will result in increased economic return.

The International Network for Family Poultry Development (INFPD) has been set up to co-ordinate research, training and/or extension in relation to village poultry production. Among the objectives of the INFPD is the encouragement of higher standards through reporting results, providing advice, and disseminating these through its biannual and bilingual (English and French) newsletter.

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