THE CONCEPT OF VALUE CHAINS IN AGRICULTURE, CLIMATE ACTION AND ENVIRONMENTAL RESOURCES

GLOBAL ISSUES & LOCAL PERSPECTIVES

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Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It is eschews pedantry and lays bars the issues in such clarity that conduces to learning. The book elaborates on contemporaneous ***The Concept of Value Chains in Agriculture, Climate Action and Environmental Resources*** issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which climate change, food security, national security and environmental resources issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue climate change, food security, national security and environmental resources necessary in policy making process that will stimulate increase in food production and environmental sustainability.

The Concept of Value Chains in Agriculture, Climate Action and Environmental Resources: Global issues and Local Perspectives is organized in three parts. Part One deals with The Concept of Value Chains in Agriculture, Part Two is concerned with The Concept of Climate Actions and Part Three deals with the Concept of Value Chains and Environmental Resources.

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Chapter Twenty Three

Sustainable Poultry Production: The Guinea Fowl Alternative

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Introduction

The domestic/scavenger guinea fowl (*Numida meleagris galeata pallas)* is a poultry bird that derives its name from the guinea coast of West Africa where it originated (Moreki and Seabo, 2012). It has cultural significance in the African context and its production is considered as an integral part of traditional activities and food source (Lengthang *et al.*, 2023; Adu-Aboagye *et al.*, 2020).

Guinea fowl (*Numida meleagris galeata pallas*) has great potentials for the rural populace of developing countries. Considering that (i) the bird thrives well in captivity under semi-intensive conditions (ii) forages well, and require little attention (iii) it is hardy, it grows, reproduces and yields well in adverse climatic conditions, (iv) it is relatively disease free; it requires little water (v) it is almost easily raised along with other birds like chicken and turkey (vi) it can be useful all year round for either meat or egg production (vii) they have a tame and non-aggressive disposition.

The potential of guinea fowl to increase egg production in Nigeria unarguably deserves attention (Yakubu *et al.*, 2019). Similarly, guinea fowl's potential for increasing meat production among poverty stricken nations of the world should be given greater recognition (NRC, 1991). The birds are widely known in Africa and occur in a few areas of Asia, however, they indicate promise for use throughout Asia, Latin America and increased use in Africa itself. Newly created strains for egg and meat production (in Europe particularly France) show excellent characteristics, for industrial-scale production (Ivanova, Nikolova, and Veleva, 2020).

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Outside Europe, almost all guinea fowls are raised as free-ranging birds. They move around villages and farmyards scavenging for food. Their cost of production is therefore low and they provide food and income for subsistence farmers. However, in Europe majority of the birds are raised under confinement, with artificial insemination, artificial lighting and special feeding with the aim of producing meat for special markets.

Guinea fowl production has increased all over the world. Most of Europe's chicken farmers and breeders wishing to diversify production, have switched over to guinea fowl production. The United States of America (USA) has also studied ways of establishing industrial production and both Japan and Australia are increasing their flocks. However, there is still great need to fully tap the vast potentials of these birds. Full scale domestication of guinea fowl (*Numida meleagris)* has not been attempted in Nigeria due to little or lack of attention that has been directed at its commercial viablility/production (Koné, Kouassi, Kouakou, and Kouba, 2018; Moreki and Radikara, 2013; Ocheja *et al.*, 2011). This chapter therefore looks into the sustainable production of guinea fowls towards attaining self reliance, food security, reducing unemployment and alleviation of poverty and protein deficiency in Nigeria, Africa and the world at large.

Appearance and size

Guinea fowl adults weigh about 2.5kg they have dark grey feathers with small white spots. Their heads are bare with bony ridge (helmet) on top which makes them resemble the vulture. The chicks (keets) look like young quails. They are brown striped with red beaks and legs. Both sexes are indistinguishable until they attain eight weeks of age and after this period the male's larger helmets and wattles and cries of the different sexes can be identified. Both male and female give a one-syllable shriek, but females also give a two-syllable call.

Globally domestic types include:

i. Pearl

ii. White

iii. Royal purple

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iv. Lavender

The pearl is the most common and probably the type first developed from the wild West African birds. The beautiful feathers are often used for ornamental purposes. The white type of guinea fowl is basically white from the time of hatching and has lighter skin.

Varieties and Distribution

Industrial guinea fowl production is dominated by Europe, France, Italy, Hungary and the Soviet Union, which raise millions of guinea fowl under intensive conditions, just as in the chicken industry. In other places guinea fowl have become established as semi-domesticated species on small family farms. Native flocks are found in villages and homes in parts of East and West Africa; free-ranging flocks are also present in parts of India. In Central America, Malaysia and Jamaica, the birds have reverted to the wild state and are treated as game (wild life).

There are five (5) known varieties of guinea fowl in Nigeria; namely: pearl (black plumage splashed with white), Lavender (ash colour plumage); Black (dark plumage); white (pure white plumage) and grey breasted. The most common however, are the pearl and grey breasted guinea fowl; *Numida meleagris galeata pallas.* In Nigeria they occur in grassland areas spreading from the Savanna near the forest zone in the South through the true Savanna into the Northern guinea Savanna vegetation zone of Nigeria. Guinea fowls are abundant in most places and wild guinea fowls are not threatened by extinction. The National Conference on guinea fowl production organized by Kainji Lake Research Institute (KLRI) exposed the production potentials of guinea fowl in Nigeria (Koné, Good, and Kouba, 2020; Yakubu *et al.*, 2019; Duru, 1987). The species constitutes about 25% of the total poultry production in Nigeria with Sokoto state recording the largest proportion (Duru, 1987). Out of the total 43million domestic guinea fowls in the country, Sokoto state had about 7.5million, which represents about 16% (Ayeni and Ayanda, 1983).

Habitat and Environment

Guinea fowls are native to the grasslands and woodlands of most of Africa, South of the Sahara where they occupy all habitats with the exception of dense forests and deserts. They have an inherent adaptability to both heat and cold. However, it is pertinent to note that in cool climates, irrespective of day length they will not start egg production until the temperatures exceed 15^{o}C.

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Biology

Egg Production

The success of the guinea fowl enterprises is majorly based on egg productivity as well as its hatchability and fertility (Yakubu *et al.,* 2019). Guinea fowls lay their first eggs at about 28-32 weeks of age while in captivity. However, in the wild, production starts at 28-42 weeks (Ayorinde, 1990). Unlike many wild birds that produce a single clutch / year, guinea fowl hens lay continuously until adverse weather sets in. Free-range domestic guinea fowl hens lay about 60-100 eggs/breeding season. Well managed birds under intensive management lay about 150-200 eggs/breeding season. The eggs are smaller and weigh about 38-48g. The egg shells of guinea fowls are about thrice stronger than those of chickens and are normally brown, but sometimes they can be tinted or white. A clutch of 15-20 eggs are common and the incubation period is 27 days. According to Ayorinde (1990) the birds lay double the number of eggs in their second year of production and laying may continue for seven or more years. The guinea fowl hen goes broody after laying and this phenomenon can be overcome by removing most of the eggs. It has been established that egg production in guinea fowls can be increased by providing additional artificial illumination at dusk or in the early morning (Gonzalez, 1981). In Africa guinea fowl eggs are often sold as hard-boiled eggs in local markets/rural markets during the laying season (Baimbill-Johnson *et al.,* 2021; Molina-Flores *et al.,* 2020; NRC, 1991; Balma, 2016). In the Soviet Union, they are produced in large commercial operations. In France, guinea fowl strains that grow quickly and lay up to 190 eggs/year have been developed. According to Olomu (1983) the guinea fowl eggs have higher protein content (14.3%) in comparison to eggs of some other poultry birds like chicken (12.8%), duck (13.5%), turkey (13%) and geese (14%). The guinea fowl eggs also have a lower lipid content of (9.5%) in comparison to chicken (11.5%) duck (14.5%), turkey (12.0%) and geese (13.4%).

Feeding

Guinea fowl scavenge on a wide range of food which include insects, earthworms, leaves, tender shoots, ant eggs, invertebrates such as slugs, seeds/grains and left over food. They are renowned foragers and are valued for their ability to destroy worms and harmful insects such as a range of beetles, locusts and termites. *Numida meleagris galeata pallas* rather than being pests of agricultural crops they are beneficial to farmers by feeding on weeds and insects injurious to crops.

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In Nigeria, mostly under the extensive system of production the only source of food for guinea fowls is the scattering of guinea corn especially during the growing phase in order to build home attachment. This practice is carried out on a regular basis in the morning and evening to condition the birds to have homing instinct and thereby encouraging their return home at feeding time.

The recommended protein requirements of guinea fowls according to (Olomu, 1983 and Duru 1987) at all levels of production are as follows:

Age of Birds	Percentage Protein Requirement
0-4 weeks	20-26
5-8 weeks	18-20
9-12 weeks	15-17
12 weeks-point of lay	14-15
Laying period	16-17

Guinea fowls should be provided with clean water ad-libitum since they drink more water per unit dry matter intake than the local or exotic chicken.

Behaviour

The guinea fowls never become "completely tame" however, they have homing instinct, they always return. It is pertinent to note that they stray further than chickens. They hide their eggs in bushy corners, often in hollows dug in the ground. They can fly, but do not fly far. They prefer to roost on high branches and they are difficult to catch during the day. Even though wild guinea fowls live in groups they are monogamous in nature and tend to relate in pairs. However, in domestication a single male may serve four or more females. They are brave and will attack even large animals that threaten them. They become agitated at the sight of predators (Soara *et al.*, 2020).

Reproduction

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Guinea fowls are territorial (they live in groups) and monogamous by nature and adult guinea fowls separate out into breeding pairs at the onset of rainy season. However, small groups of juvenile and non-breeding birds stay together throughout the rainy season. Reproduction and egg laying in guinea fowls is confined to the rainy season due to the availability of abundant insect rich protein diet and green pastures. In West Africa laying in guinea fowls can be induced by spraying the birds with water (GALOR, 2021; Ahiagbe *et al.*, 2021; Camas-Robles *et al.*, 2020; Wilson In: NRC, 1991).

Fertility

Fertility has been identified as a major problem in guinea fowl production with particular reference to the ratio of male to female to be used in the mating programme. A male /female ratio of 1:4 and 1:5 has been recommended for effective coverage (Offiong 1983). Fertility of guinea fowls have been documented to range from 70-85% (Agbolosu *et al.*, 2012), while hatchability ranges from 72-80% (Ahaotu *et al.*, 2013; Farrel, 2017; Abdul-Rahman and Adu, 2017).

Health

Guinea fowls are hardy in nature. Due to the free-living and scavenging habit of guinea fowls they are infested by many parasites which includes *Ascarida galli*, *Emeria* species, *Pullorum*, *Plasmodium* species etc. Ticks and lice have also been recorded as forms of external parasites.

Under intensive and commercial systems of production, the diseases which cause problems include coccidiosis, aspergillosis and worm infestation. Guinea fowls under these systems are also susceptible to pullorum infection.

Products and Marketing

The demand for guinea fowls in Nigeria exceeds the supply thus due to the short supply, the price of guinea fowls have maintained an upward trend. Presently, an average adult guinea fowl costs about **₦6000 and each egg sells for about ₦150.** An estimated 650,000 and 540,000 guinea fowl eggs were sold in 1980 and 1981 (total for months of July and August) respectively by wholesalers in Maiduguri main market alone (Oguntona, 1983).

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Uses

- Guinea fowls provide best opportunitries for small scale farmers and the rural populace to access eggs and meat at low cost.
- They contribute to household income and economies of rural communities through marketing of egg and meat thereby alleaviating poverty.
- They increase food self-sufficiency in animal proteins (eggs and meat) thereby alleviating protein deficiency
- They can be used to control insects pests (like grasshoppers) on crops and in vegetable gardens
- They are good 'watch animals' they have fantastic eyesight, harsh cry and they shriek at the slightest provocation. Their agitation on sighting dogs, foxes, hawks and other predators have saved the lives of many chickens, ducks and turkey from predator attacks.
- Attractive plumages (used for decoration and other traditional practices).

Guinea Fowl Meat

Domestic guinea fowl meat is dark and delicate; the taste is similar to that of game birds. It is a special delicacy, served in some of the world's finest restaurants. Many European countries consume large amounts of guinea fowl meat. The annual consumption in France is about 0.8Kg per capita (Mongin In: NRC, 1991). *******

Husbandry/Management

Intensive System

Guinea fowl can be raised intensively in confinement using the techniques for raising battery chickens. Under this system, breeding stocks are housed in cages and are artificially inseminated. Even though the intensive system of production gives best egg production (up to 190-200 eggs/season) and fertility, it is capital intensive due to housing, feeding, health and equipment requirements. It also requires skilled labour thus the system is uneconomical.

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Semi Intensive (Semi Domestic)

The birds can be reared in a semi domestic state (fenced range) around the farmyard. In such systems they are penned until they are 12 weeks old. They constantly return to their source of homemade mixture/artificial food, since they are not familiar with foraging for natural food, however, gradually they learn to subsist by scavenging. At times there is a health control regime /programme available for the birds. The semi-intensive system with fenced range appears economically feasible and a desirable means of boosting guinea fowl production by peasants. The fenced range should provide similar conditions to the natural habitat (grass and bush shrubs) of birds

Extensive System

Guinea fowls are mostly raised under the extensive production system in Nigeria (Kyere *et al.*, 2020; Ayeni and Oyedipe, 1981). Under this system the birds are not confined at any point in time with the implication that they must scavenge for feed. However, they may be given little quantity of grains. The system seems economically feasible and more desireable as a means of boosting guinea fowl production by peasants. The eggs from the guinea fowl hen are given to broody local chickens to incubate and hatch. The emerging young fowls run around with the local chicken in farm, yards in the rural villages. The growing guinea fowls abandon the chicken as soon as they can fly into shelter of tall trees. Young guinea fowls are more difficult to rear than pullets. In their first week of life they require a slightly higher environmental temperature of 36-40^{0}C. This management system has been discovered to be unfavourable for guinea fowls because their body weight decreases during the cold harmattan, thus indicating the need for shelter.

Care of the young (Keets)

Guinea fowls have been called "the worst parents in the world" since they are almost incapable of looking after their young ones (keets). They are difficult to catch and they can easily suffocate the keets when they are panicked. Therefore, considering the fact that the guinea fowl hens are indifferent mothers, the eggs are best hatched in incubators or under other birds to avoid losing of keets by their natural mothers. Losing half of the chicks on a 5km walk through the bush on day of hatching is unusual (Kyere *et al.*, 2021; Hutton, In: NRC, 1991)**.** In many African countries Nigeria inclusive guinea fowl eggs are hatched under indigenous/local chickens. Keets are often

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kept indoors until they are 3-4 weeks old to protect them from wet weather and predators. Sexual maturity in guinea fowls can be delayed to as long as 32 weeks of age by holding the birds in windowless housing and controlling the lighting. This phenomenon improves egg size and hatchability, and reduces early mortality. Natural incubation which is common in smallholder guinea fowl production systems does not produce many keets to guinea fowl flocks thereby culminating to the undervelopment of the guinea fowl enterprises across the continent (Dahouda *et al.*, 2008).

Advantages of guinea fowl in comparism to local (farmyard/indigenous chicken)

In comparism to farmyard chicken guinea fowl has the following advantages

- Low production costs
- Premium quality meat (game meat)
- Hardy nature
- Greater capacity to utilize forages /green feeds well
- Better ability to scavenge for insects and grains
- Better ability to protect itself against predators
- Better resistance / resilience to common poultry parasites and diseases e.g. Newcastle disease and fowl pox. However, they are susceptible to common diseases of chicken and turkeys like salmonella which is prevalent. Others are pullorum diseases styphylococcus and mareks disease.
- Less destructive to garden or crops because they don't scratch to get insects out of the soil.
- Low attention
- Reproduces and yields well in both cold and hot conditions (themal tolerant)
- Low water requirement
- Easily raised like chicken and turkey
- Short reproductive cycle
  Bonkoungou, 2005; Dieng at al, 1999; Mandal *et al.*, 1999; Bond *et al.*, 1999

Limitations of Guinea Fowl Production

Like all other economic enterprises, guinea fowl production is not devoid of constraints. The main constraints against guinea fowl production include:

- High rates of keet mortality

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- Inadequate acess to veterinary services
- Low productivity of local breeds (seasonal egg production and poor fertility associated with hatchability)
- Poor management practices
  Balma *et al.*, 2016; Nwagu and Alawa, 1995

Potential of Guinea Fowl for Backyard/Village/Subsistence Production

It is important to note that village or subsistence production of guinea fowl has greater potentials for backyard production because the cost of producing it intensively costs more in comparison to chicken. In Europe for instance, day-old keets cost about twice the cost of day-old broiler chicks because guinea fowl produces fewer hatching eggs and require a longer feeding period and also because guinea fowl are expensive to feed. Their feed conversion efficiency is about 3.3-3.6 as compared with broilers' feed conversion of 1.8-1.9. Guinea fowls take twice longer time to reach market size, they are marketed for meat at age 12-14 weeks in comparison to broilers at 7-8 weeks. Thus the selling price of guinea fowl in the western world is twice that of broilers.

Research Conservation Needs of Guinea Fowl for Sustainable Production

In view of the great potentials of guinea fowl production, breeders need to carry out more research on the bird, under free range system of management in order to improve the birds' productivity with particular regards to its growth rate, egg production, fertility, hatchability and health amongst others.

Husbandry research should be directed towards the constraints related to the guinea fowl breed as follows:

- Feeds and feeding systems for both growing and breeding stock
- Increased hatchability of eggs under natural conditions (under guinea hens or surrogate mothers)
- Identifying the best lightening regimes for sexual maturity and rate of egg lay since they are influenced by changes in day length

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Agencies involved in international economic development should promote guinea fowl production towards improving the socio-economic status of small scale farmers in the rural poor/resource poor and peri urban communities. Their attention should also be geared towards motivating the emergence of commercial and industrial guinea fowl enterprises in Nigeria.

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References

Abdul-Rahman I I, & Adu, Y.E (2017). The role of the rural farmer in guinea fowl Numida meleagris value chain, a case study of the Tolon district. *Livestock Research for Rural Development*, 29(4),1-13.

Abdul-Rahman, I.I and Adu, Y.E.(2017). The role of the rural farmer in guinea fowl *Numida meleagris* value chain, a case study of the Tolon district. Livestock Research for Rural Development. 29(72). Retrieved November 12th 2024, from http://www.lrrd.org/lrrd29/4/iddr29072.html

Abdul-Rahman, II, Robinson, J.E., Obese F.Y., Jeffcoate I.A & Awumbila B (2016a) Effects of season on the reproductive organ and plasma testosterone concentrations in guinea cocks (*Numida meleagris*). *Poultry Science*, 95 (3): 636-644.

Abdul-Rahman, II., Awumbila, B., Jeffcoate I A, Robinson, J.E & Obese F Y (2015) Sexing in guinea fowls (*Numida meleagris*). *Poultry Science* 94: 311-318.

Abdul-Rahman, II., Obese, F.Y, Robinson J E, Awumbila B & Jeffcoate, I.A (2016b) Effects of season on the reproductive organs and steroid hormone profiles in guinea hens (*Numida meleagris*). *British Poultry Science*, 57(2): 280-286.

Adene, D.F. and Dipeolu, 0.0. (1975): Survey of blood and ecto-parasites of domestic fowls in Ibadan, Western State of Nigeria. Bull of Animal Health. African 23, 233-335.

Adeniyi, O.R & Oguntunji, A.O (2011). A socio-economic survey of cultural practices and management of village poultry production in Ondo area, Nigeria. Livestock Research for Rural Development 23 (12). Retrieved on 20th October, 2020 from: www.lrrd.org/lrrd23/12/aden23261.htm.

Adu-Aboagye, G., J. K. Nyameasem, K. M. J. Ahiagbe, K. O. Ansah, G. A. Zagbede, and K. K. Agbe. (2020). “Reproductive Traits of the Indigenous Guinea Fowl under Tropical Humid Conditions: The Effect of Egg Size.” Livestock Research for Rural Development 32: Article #55. http://www.lrrd.org/lrrd32/4/gadua32055.html .

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Agbolosu, A.A., Teye, G.A., Adjetey, A.N.A., Addah, W. and Naandam, J. (2012). Performance Characteristics of Growing Indigenous Guinea Fowls from Upper West and Northern Regions of Ghana. *Agriculture and Biology Journal of North America*, 3(8): 336-339

Ahaotu., E.O., Umoh. G., Onweagba, A. E., Chukwu, A. O. and Iwuanyanwu, U.P. (2013). Guinea Fowl keets performance under improved and extensive conditions in Anthony Patience Farms, Atta-Ikeduru, Imo State, Nigeria. *International Journal of Agriculture and Biosciences* 2(2):82-86

Ahiagbe K M J, Amuzu-Aweh E N, Bonney P, Nyameasem J K, Avornyo F K, Adenyo C & Kayang B B (2021). Comparison of early growth and survivability in indigenous guinea fowls from Northern Ghana. Tropical Animal Health and Production, 53, 1-17.https://doi.org/10.1007/s11250-020-02510-4.

Ahuja,V & Sen, A (2007). Scope and space for small-scale poultry production in developing Countries. Indian Institute of Management, Ahmedabad, India. Retrieved on 8th March 2022 from: http://www.fao.org/ag/againfo/home/events/bangkok2007/docs/part3/3_3.pdf

Akinboade, O.A. and Dipeolu O.O. (1991): Investigation on the parasite of turkey in Oyo state, Nigeria. *Nigerian Journal of Parasites*,1(1):44-48.

Annor, S.Y., Apiiga., S.Y. & Ahiaba, J. (2012) A Handbook on Guinea Fowl Production in Ghana, 1st edition. Quality type Limited, Accra. pp 1 – 91.

Apiiga, S.Y (2007). Improving Guinea Fowl Production in the Upper East Region. The Savanna Farmer 8(2).

Ayanda, J.O. (1979): Economic of guinea fowls production. Kainji Lake Research Institute, Annual Report, New Bussa, 64-65.

Ayanda, J.O. (1983): Socio-economic aspects of guinea fowl free-range production in Kainji lake basin in Nigeria: In The Helmet Guinea (*Numida meleagris galeata pallas*) in Nigeria. Edited by J.S.O. Ayeni, J.SO. Olomu, J.M and Aire, T.A.) Kainji Lake Research Institute, New Bussa, Nigeria, pp40-49.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Ayeni, J.S.O. (1980): The biology and utilization of helmet guinea fowl in Nigeria. Ph.D. Thesis, University of Ibadan, Nigeria.

Ayeni, J.S.O. and Ajayi, S.S. (1983): The ecology and management of helmet guinea fowl *Numida meleagris galeata pallas*) in Kainji Lake Basin Area of In: The Helmet Guinea Fowl Nigeria *Numida meleagris galeata pallas*) in Nigeria) Kainji Lake Research Institute, 21-32.

Ayeni, J.S.O. and Ayanda, J.A. (1982) Studies of the husbandry and social acceptance of guinea fowl in Nigeria. Bulletin of Animal Health and Production, Africa 30: 139-148

Ayeni, J.S.O. and Oyedipe, F.P.A. (1981): Protein abundance through guinea fowl production. Paper presented at National Conference on From Food Deficiency to Food Sufficiency. Rivers State University of Science and Technology, Port Harcourt.

Ayeni, J.S.O., Dipeolu, O.O. and Okaeme, A.N. (1983) Parasitic infections of grey-breasted helmet guinea (Numida meleagris galeata) in Nigeria. *Veterinary Parasitology* 12: 59– 63

Ayeni, J.S.O., Dipeolu, O.O. and Okaeme, A.N. (1983): Parasitic infection of the grey breasted helmet guinea fowl (*Numida meleagris galeata pallas*) in Nigeria. Vet. Parasite 12, 59-63

Ayeni, J.S.O., Tewe, O.O. and Ajayi, S.S. (1985):Growth performance of guinea fowl in Kainji Lake Area of Nigeria. Journal of Tropical Forest Resources 1:21-27.

Ayeni, S.O., Tewe, O.O. and Ajayi, S.S. (1985): Protein requirement of grey breasted helmet guinea fowl in Nigeria. Journal of Tropical Forest Resources 1:20.

Ayeni. J.S.O. (1981): Aspects of the biology of the helmet guinea fowls (*Numida meleagris galeata pallas)* in Nigeria. Journal of World Pheasant Association 6:3139.

Ayeni. J.S.O. and Ayanda, J.O. (1983): Studies of husbandry practices and social acceptance of guinea fowl in Nigeria. Bulletin of Animal Health and Production in Africa 30(2):139- 148.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Ayorinde, K.L. (1990). Problems and Prospects of Guinea Fowl Production in the rural areas of Nigeria. In: Rural Poultry in Africa (Proceedings of an International Workshop on Rural Poultry Development in Africa), (Ed. Sonaiya, E.B). *African Network on Poultry Production Development* Pp. 106-115.

Baimbill-Johnson N, Anaman, K.A. & Amegashie, D.(2021). Evaluation of the resource efficiency of guinea fowl production in the Savelegu-Nanton District of the Northern Region of Ghana. *Journal of Development and Agricultural Economics*, 13(2), 142-155. https://doi.org/10.5897/JDAE2020.1223.

Balma, Y.I. and Richard N.Y. (2016): Socio-Economic Attributes of Guinea Fowl Production in Two Districts in Northern Ghana. *African Journal of Agricultural Research*. (AJAR)Vol. 11(14): 1209-1217.

Bell, M. & Smith K. (2010). Guinea fowl production. Queensland Department of Primary Industries. Accessed 28 January 2012 from www.dpi.qld.gov.au

Belshaw, R.H.H. (1985) In: NRC: (1991): National Research Council. (1991) Micro-Livestock: Little-known Small Animals with a Promising Economics Future: Guinea Fowls of the World. National Academy Press, Washington, D.C. pp 115-121

Blum, J.C., Guillaume, J. and Leclercq, B. (1975): Studies of the energy and protein requirement of growing guinea fowl. *British Poultry Science*, 16: 157-168.

Bonds, H. (1997): Alternative Farming: A United Nations Alternative Farming on the Mornington, Peninsula, pp1-4

Bonkoungou, G.F.X. (2005): Characteristics and Performance of Guinea Fowl Production under Improved and Scavenging Conditions in Sahelian Region of Burkina Faso. Unpublished M.Sc. Thesis. The Royal Veterinary and Agricultural University, Copenhagen, Denmark.

Camas-Robles, G., B. Ruiz-Sesma, P. Mendoza-Nazar, R. Portillo-Salgado, A. Hernández-Marín, and Cigarroa-Vázquez, F. (2020). "Productive Behavior and Composition of the Carcass of the Guinea Fowl (*Numida Meleagris*)." Abanico Veterinario 10: 1–14. doi:10.21929/abavet2020.34.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Carew, S.N., Olomu, J.M., Sekoni., Offiong, S.A. and Olorunju, S.A. (1983): The characteristics and quality of guinea fowl eggs In: The Helmet guinea fowl *Numida meleagris galeata pallas)* in Nigeria. Ayeni, J.S.O (ed) University Press , pp1-85.

Comla, S., Pitala1, Lare, W., Lombo L. and Yao (2022). Effect of the season and the sex ratio on the laying performance and on the reproduction performance of indigenous guinea fowl (*Numida meleagris*) in South Togo. *J. Anim. Plant. Sci* 52:9503-9511

Dahouda, M., Senou, M., Toleba, S.S., Boko, C.K., Adandédjan, J.C. and Hornick, J.L. (2008). Comparison des caractéristiques de production de la pintade locale (*Meleagris numida)* en station et dans le milieu vilageois en zone soudano-guinéenne du Bénin. *Livest. Res. Rural Develop*., Vol. 20

Dahouda, M., Toleba, S.S., Youssao, A.K.I., Kongui, S.B., Aboubakari, S.Y. and Hornick, J.L. (2007). Contraintes a l'élevage des pintades et composition des cheptels dans les elevagestraditionnels du Borgou au Benin. Sviculture Familiale. 17:3-14

Dieng, A., Gueye, E.F., Mahoungou-mouelle, N.M., Buldgen, A. (1999): Effect of Diet and Poultry Species on Feed Intake and Digestibility of Nutrients in Senegal Livestock Research for Rural Development pp10:5-9

Duru , S. (1987): Guinea Fowl Production in Dundaye District of Sokoto State: An Initial Survey 41 pp.

Farrel, D. (2017). Guinea Fowl Poultry Hub. Retrieved December 15th, 2023 from www.poultryhub.org/species

GALOR. (2021). Guinea Fowl Breeders." 106 chemin du Roi ZI Boitardière 37400. Amboise, France.

Gonzalez, D.A. (1981): Effect of artificial light on egg production in the guinea fowl (*Numida meleagris*) Poultry Abstract 7 12, 431.

Gwaza, D.S., Elkanah, H. (2017). Assessment of external egg characteristics and production indices of the dual purpose. French guinea fowl under semiarid conditions in Nigeria Research and Reports on Genetics 1(1):13-17

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Hughes, B.L., Jones, J.E. (1980): Diet regimes for growing guinea fowls as meat birds. Poultry Science 59, 3, 582-584.

Issaka, B.Y and Yeboah, R.N. (2016). Socio-economic attributes of guinea fowl production in two districts in Northern Ghana Afric *J. Agric. Res.*, 11 (2016), pp. 1209-1217

Ivanova, R., M. Nikolova, and Veleva, P.(2020). "Study on Egg Productivity of Guinea-Fowls (*Numida Meleagris).*" *Iranian Journal of Applied Animal Science* 10: 727–734.

Karbo, N, Avornyo F K and Apiiga S Y 2002 Preliminary studies on the pattern and causes of Guinea fowl (Numida melegris) keet losses in Garu, Bawku East District. The Savanna Farmer 1: 15 – 17.

Kari, R.R., Hyman, A.L., Thornton, E.J. and Norman, R. (1978): Protein requirement of guinea keets. Poultry Science 57, 1, 186-189.

Kashindye, F.A (2000). A study on the production potential of guinea fowl in Tanzania. Sokoine University of Agriculture Theses and Dissertations collection. Retrieved on 30th November, 2023.from: http://suaire.suanet.ac.tz:8080/xmlui/handle/123456789/30/discover?query=Kashindye+F+A&submit=Go&rpp=10.

Kolan, S.P. & Avornyo, F.K (2013). The effect of wetland on guinea fowl (Numida meleagris) egg productivity and fertility during the dry season in the guinea ecological zone of Ghana. *Sky Journal of Agricultural Research* 2(9): 126-131.

Koné, G. A., G. F. Kouassi, N. D. V. Kouakou, and Kouba, M. (2018). Diagnostic of Guinea Fowl (*Numida Meleagris*) Farming in Ivory Coast." *Poultry Science* 97: 4272–4278. doi:10.3382/ps/pey290.

Koné, G. A., M. Good, and Kouba, M. (2020). "Performance of Guinea Fowl Fed Hevea Seed Meal or Cashew Nut Meal as a Partial Substitute for Soya Bean Meal." Animal 14: 206–214. doi:10.1017/ S175173111900185X.

Konlan,S.P., Avornyo, E.K., Karbo N. & Sulleyman, A. (2011). Increasing guinea fowl eggs availability and hatchability in the dry season. *Journal of World's Poultry Research* 1(1): 1-3.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Kouassi, G.F., Kone, G.A., Gond, M., and Kouba, M, (2019): Factors Affecting Guinea Fowl (*Numida meleagris)* Production in Ivory Coast). *J. Appl Poult. Res.* (JAPR) 28:1382- 1388

Kyere, C.G, Okyere, K., Duodu, A., Twumasi, G and Dapaah, P.K. (2020).Effect of different lighting regime on growth and reproductive performance of the Guinea fowl (Numida meleagris). *World Journal of Advanced Research and Reviews*, 07(02): 294–302.

Kyere, C.G., Okyere, K., Duodu, A., Twumasi, G., Dapaah, P.K. 3 and Poku, P.A. .(2021). Effect of light on Guinea fowl (*Numida meleagris)* production: A review. *World Journal of Advanced Research and Reviews*, 09(03), 337–345.

Leng, T.B., Tellah, M., Nideou, D. and Logtene, Y.M. (2022). Socio-économi de l'élevage de la pintade dans le Départment de la Tandjilé-Ouest, Tchard, *J. Applied Biosci*.173:17977-17989

Lenghtang, B., Tellah, M., Nideou, D., Assadi, M., Odjigue, N. and Logtene, Y.M. (2023): Guinea Fowl Farming and its Egg Production in the Western Tandjile Department, Chad. *Int. J. Poult. Sci.*, 22:24-30

Mandal, A.B., Pathak, N.N. and Singh. H. (1999): Energy and Protein Requirements of Guinea keets (*Numida meleagris)* as Meat Birds in a Hot Climate. *Journal of the Science, Food and Agriculture,* 79:523-521

Marshall, A.J. (1961): Breeding seasons and migration in biology and comparative physiology of birds. Ed. Marshall, A.J. Vol. Il.

Molina-Flores B, Manzano-Baena P & Coulibaly, M.D.(2020). The role of livestock in food security, poverty reduction and wealth creation in West Africa. FAO. https://doi.org/10.4060/ca8385en.

Mongin, P. In: NRC**:** National Research Council. (1991). Micro-Livestock: Little-known Small Animals with a Promising Economics Future: Guinea Fowls of the World. National Academy Press, Washington, D.C. pp 115-121

Moreki, J.C. and Radikara M.V. (2013). Challenges to Commercialization of Guinea Fowl in Africa. Int. J. Sci. Res. 2(11): 436-440

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Moreki, J.C. and Seabo, D. (2012).Guinea Fowl Production in Botswana. *J. World's Poult. Res.* 2(1): 01-04.

Moreki, J.C., Thutwa M., Ntesang K., Koloka O. and Ipatleng T. (2010). Utilization of the guinea fowl and Tswana chicken packages of the Livestock Management and Infrastructure Development Support Scheme, Botswana. *Livestock Research for Rural Development,* 22(11).

Musundire, M.T. (2016). Influence of Age and Sex on Carcass and Meat Quality Traits of Scavenging Guinea Fowls. Unpublished Ph.D Thesis, University of Kwazulu-Natal, Pietermaritzburg, South Africa Pp 167

Nahashon, S.N., Aggrey S.E., Adefope N.A., Amenyunu A. and Wright,,D. (2006). Growth characteristics of Pearl Gray Guinea Fowl as predicted by the Richards, Gompertz and Logistic Models. *Poultry Science,* 85: 359 – 363.

NAPRI. (2017). National Agricultural Extension and Research Liason Services, Ahmadu Bello University, Zaria. The Production of Guinea Fowl in Nigeria. Extension Bulletin, No. 207.

Ndrodza, F.N., Tshimuanga, C.K. and Rutakaza, N.B. (2022). Etat des lieux du mélagriculture dans la ville de Kisangani et ses environs, RD Congo. *Afr. Sci*., 20:15-27

Nishiwaki, M. , Kehinde, K. (1981): Effect of the photoperiod on the ovi position times in guinea fowls. Journals of Agricultural Science, 26(2): 209-215.

NRC: National Research Council. (1991) Micro-Livestock: Little-known Small Animals with a Promising Economics Future: Guinea Fowls of the World. National Academy Press, Washington, D.C. pp 115-121

Nwagu, B.I & Alawa, .B.I. (1995). Guinea Fowl Production in Nigeria. *Journal of World's Poultry Research*, 51:260-270

Nwagu, B.I. and Alawa, C.B.I. (2007).Guinea fowl production in Nigeria, Journal of *World's Poultry Science Journal*, 51(3): 261 - 270.

Obioha, F.C. and Okonkwo, I.U. (1983): Energy and Protein requirement of growing guinea fowl In: The Helmet guinea fowl (*Numida meleagris galeata pallas)* in Nigeria. Ed Ayeni, J.S.O

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Ocheja, J.O., Okpanachi, U. and Okpe, A.A. (2011). Management problems of guinea fowl production in Nigeria. Proceedings 36th Conference of Nigerian Society for Animal Production. University of Abuja. Pp. 296-298

Offiong, S.A. (1976): Establishment of the guinea fowl project at Vom. Samaru Agricultural Newsletter 18: 64-68.

Offiong, S.A. (1983): Management problems of guinea fowl production in Nigeria IN: The helmet guinea fowl (*Numida meleagris galeata pallas*) in Nigeria. Ed Ayeni, J.S.O. Olomu, J.M, and Aire, T.A. (eds): The helmet guinea fowl (meleagris galeata pallas) in Nigeria.

Offiong, S.A. and Abed, S.M. (1980): Fertility hatchability and malformation in guinea fowl embryos as affected by dietary managanese. British Poultry Science 21(5): 371-375.

Ogundipe, S.O. (1976): The raising of guinea fowls. AERLS Extension Guide No. 83, Poultry Series No. 10 AERLS/ABU, Zaria.

Oguntona, T. (1983): Current Knowledge of Nutrient requirement of the grey breasted helmet guinea fowl. In: The helmet guinea fowls (*Numida meleagris galeata pallas*) in Nigeria. Ed. Ayeni, J.S.O., Olomu, J.M. and Aire. T.A.). Kainji Lake Research Institute, New Bussa, Nigeria, pp 121-128

Okaeme, A.N. (1982): Guinea fowl reproduction in Nigeria. *World Poultry Science Association Journal*, 38, 36-39.

Olomu, J.M. (1983): Aspects of the nutrition of guinea fowls. In: The helmet guinea fowls. (Numida melaegris galeata pallas) Ed. Ayeni. J.S.O.

Oluyemi, J.A. (1982): Management of Turkey, Duck, Goose, guinea fowls and game bird. *Monograph.* Dept. of Animal Science. University of Ibadan.

Onunkwo, D.N., Okoro, I.C. (2015). Egg Production Performance of Three Varieties of Guinea Fowl in Humid Tropics. *Int. J. Cur. Res. Rev* (IJCRR). Vol 7. (8)

Otte, J. (2006). The Hen Which Lays the Golden Eggs: Why Backyard Poultry are so Popular?", PPLPI Feature, Retrieved online 17th July, 2022 from: www.fao.org/ag/pplpi.html.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Prabakaran, R. and Valavan, S.E. (2020): Production Performance of Guinea Fowl in Hily Area of Tamil Nadu, India. *Journal of Entomology and Zoology Studies* (JEZS) 2020, 8(2):440-442

Saina, H, Kusina, N. T, Kusina,J. F., Bhebhe, E & Lebel S (2005). Guinea fowl production by indigenous farmers in Zimbabwe. Livestock Research for Rural Development. 17(101). Retrieved November 12th, 2024, from http://www.lrrd.org/lrrd17/9/sain17101.htm

Saina, H. (2005): Guinea Fowl (*Numida meleagris)* Production Under Small Holder Farmer Management in Guruve District, Zimbabwe. Unpublished M.Sc. Thesis, Department of Animal Science, Faculty of Agriculture, University of Zimbabwe Pp. 99

Soara A E, Talaki E, Dayo G K, Oke O E, Belem A M G & Tona, K (2020). Indigenous Guinea Fowl (*Numida meleagris*) Production in West Africa: Inventory, Performances and Constraints-A review. *European Poultry Science*, 84.https://doi.org/ 10.1399/eps.2020.303.

Tewe, O.O. (1983): Nutrient requirement of the guinea fowl. In: The helmet guinea fowl (*Numida meleagris galeata pallas)* in Nigeria. Ayeni, J.S.O., Olomu, J.M and Aire, T.A). Kainji Lake Research Institute, New Bussa, pp.1-9.

Ukoli, F.M.A (1983): Research in parts for the domestication and commercial production of the guinea fowl.In: The helmet guinea fowl. *Numida meleagris galeata pallas)* Ayeni, J.S.O., Olomu, J.M and Aire, T.A). Kainji Lake Research Institute, New Bussa, pp.1-9.

Wilson, R.T. In: NRC: National Research Council. (1991) Micro- Livestock: Little-known Small Animals with a Promising Economics Future: Guinea Fowls of the World. National Academy Press, Washington, D.C. pp 115-121

Yakubu, K., Ibrahim, T., Egbo, M. L., Shuaibu, A. and Umar, H. A.(2019).Some Factors affecting Incubation Parameters of Guinea Fowl (*Numida meleagris)* Eggs. *Nigerian Journal of Animal Science and Technology*,2 (1):97 - 106

Yakubu, K., Ibrahim, T., Egbo, M.I., Shuaibu, A. and Umar, H.A. (2019): Some Factors Affecting Incubation Parameters of Guinea Fowl (*Numida meleagris)* Eggs. *Nigeria Journal of Animal Science Technology* (NJAST) Vol. 2 (1): 97-106

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1

Zvakare, P.,Mugabe, P.H. & Mutibvu, T. (2018).Guinea fowl (*Numida meleagris*) production by small-holder farmers in Zimbabwe Trop. *Anim. Health Prod.*, 50:373-380.

SAEREM BOOK CHAPTERS First Published 2025 ISBN 978-978-60709-7-1