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.

Eteyen Nyong/ Ignatius Onimawo

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Chapter Fourteen

Geese Production for Food Security

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Introduction

Geese (*Anser spp*) are among the first groups of domesticated animals, however they are yet to get wide recognition in terms of the level of commercialization or industrial exploitation accorded to the chicken, turkey or duck production industry even though they have tremendous potentials. Geese reared in family farms under small scale production systems contribute immensely to reducing hunger and malnutrition with low level of inputs and proper management of natural resources (Salamon, 2024; Pingel, 2009). However, large scale / commercial production of geese require more resources in terms of welfare of the birds with regards to housing and feeding (Pingel, 2009). Geese farming promise good profitable future enterprises in places where water bodies, paddy fields and good ranges are available (Hoque, Phookan, Goswami, Kalita, Das, Das, Hussain, and Khanikar, 2023; Gogoi, 2020). According to Saatci (2009), geese rearing have been an ancient tradition in Asia and Europe with attention being focused on the meat production of native geese breeds in recent years. Geese have also been farmed for fatty liver as well as downy coat of feathers (Dumlu, 2024; Kozák, 2011).

The use and manipulation of lighting programmes for all-year-round breeding that brought great benefits to the poultry industry has not been achieved in geese farming in comparison to chicken and turkey production with the consequence that geese continue to have a short breeding season. Large flocks of geese are kept in country sides by peasants while individual birds are reared in towns (Albarella, 2005). Backyard production of geese has been popular and they have also been produced commercially in specialized farms all over the world. However, economic importance of geese farming is well established in Asia and Central Europe (Goluch and Haraf, 2023; Hamadani *et al.*, 2017). According to FAOSTAT (2020) goose meat produced in Asia was 95.9%, Europe 2.4% and in Africa 1.4%.

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The fast growth rate and nutritious meat of geese (Hamadani *et al.*, 2014 and 2013a) makes geese farming enterprise a promising one. Inspite of all the tremendous potentials and advantages of the domestic geese it has remained a neglected species in many countries Nigeria inclusive. The lack of scientific knowledge on all aspects of geese farming and husbandry are some of the greatest impediments to the development of geese farming (Lin, Liu, Shen, Huang, Chen, Lin, and Jia, 2024; Hamadani, 2014). The increasing demand for free range poultry meat has brought the breeding of geese and turkey into the limelight due to their high foraging instincts / capabilities, which makes their meat to be more organic in nature. With due consideration to the issue of protein deficiency, poverty and unemployment ravaging most rural communities in most third world countries Nigeria inclusive geese rearing presents an alternative for sustainable protein production, poverty alleviation and job creation. Therefore, this chapter explored the potentials of geese reared under backyard /scavenging conditions (extensive free range foraging system) towards alleviating protein deficiency, attaining food self-sufficiency, reducing unemployment and providing income for resource poor communities.

Potentials of Geese Production

- Domesticated geese are easily managed (due to zero input system)
- Mortality is usually low provided they have good care and protection from predators
- Well suited to small-farm production
- Has good potentials for meat production (high quality protein and fat)
- A good source of supplemental income for farmers
- High dietary meat quality that commands high premium (Hamadani *et al.*,, 2013a), reported that consumers highly favoured goose meat in terms of specific traits: appearance, texture, taste and overall acceptability compared to chicken meat and mutton.
- High ability to use high fibre feeds,
- High disease resistance
- Good adaptation to free range and grazing (serve as weeders)
- High juvenile growth rate
- Huge eggs (tastes like chicken eggs)
- Produces rich fat for cooking
- Produces soft down feathers for beddings and clothings. Thus it is useful in the textile industry (Adult geese produces a total of 150-230g of valuable feathers)

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- Serve as a form of security against strangers and predators due to their sound which serve as alarm). In South-East Asia (the high Andes), the birds have replaced guard dogs. In Europe they are used to guard whisky ware houses and sensitive military installations, also, their elongated necks help them to keep watchful eyes on their surroundings
- Produces fattened liver of high nutritive value
- They don't compete for grains with man as chickens do.
- Their long necks enable them get food from difficult ends

Habitat and Environment

They are well adapted to aquatic environments and marshy lands. They are also well suited to warm shallow waterways. However, they can survive in the absence of water environment. They can be domesticated any where provided pasture is available. They thrive well in hot climatic regions provided good shade is available (Camiruaga-Labatut, 2002). The possession of water-proof feathers helps them to adapt to high rain fall regions. Geese are well adapted to walking or swimming with the aid of their long legs and webbed toes. Thus they are able to move for long distances to find forage and return home at dusk. As good swimmers, geese are able to swim in water soon after they hatch from eggs. Inspite of their large size, certain domestic breeds (particularly the leaner types have been able to retain their ability to fly. They are also able to tolerate extreme cold e.g. in Canada geese are produced outdoors during winter at subfreezing temperatures with only a simple shelter from wind.

Feeding

Geese can be raised exclusively on succulent pasture because they are grazers (NRC, 1991). By the time they attain 5-6weeks of age they obtain a lot of their diet from pasture. They are extremely good foragers which can sustain themselves adequately on succulent grass. They pull off grasses and underwater plants, and also probe soil and water for roots, bulb and aquatic organisms by using their powerful bills. Their long necks stand as added advantage for feeding by allowing them to pick weeds from difficult heights or hard-to-reach places e.g. fences, ditches, swampy areas compared to other forms of livestock.

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Geese are capable of utilizing large quantities of tender forage. They break down plant cell walls and digest the contents. Even though the goose has no crop for storage of food, it has an enlargement at the end of the gullet which serves as a temporary storage organ. Geese also swallow little particles of sand and small gravels along with its food to help the gizzard in grinding hard seeds and fibrous grasses. Research has indicated that geese are capable of digesting 15-10% of the fibre in their diet, which in relative terms is 3-4 times the quantity that other poultry species can digest. The natural diet of geese include grasses, seeds, roots, bulbs, berries and fruits which are supplemented with little animal matter (insects and snails) picked by the birds. They feed mainly on land. They are noted for feeding for longer periods of time which run through the night. Geese require constant and regular supply of clean drinking water throughout daylight period. Even though swimming water is not absolutely necessary for the birds, however it enhances cleaner and healthier birds since it facilitates care of plumage.

Husbandry/Distribution

Systems of management of adult geese vary in accordance to climate, breed, peoples' experiences and needs. Geese are widely distributed globally in most regions of the world. Geese farming/production is only economically important in Asia and Central Europe. Most geese are well adapted to hot climates provided some shade is available (Brassó, Komlósi and Barta, 2024)..

Appearance and Size/Breeds

Domestic geese types are of various colours, sizes and shapes. The European and North American breeds include Embden, Toulouse, Pilgrim, American, Buff, Pomeranian, Sebastopol and Tufted (NRC,1991). Roman breeds and these breeds which are well adapted to temperate climates are the descendants of greyleg goose (*Anser*). The Chinese and African types of geese are better adapted to hot climates. The geese of Asia are descendant of the wild "swan goose" (*Anser cynsoides*).

Potentials of Chinese and European Breeds for Tropical Regions

The Chinese type which is widely domesticated in South-east Asia has been noted to be greatly promising for tropical developing countries. These types are usually smaller than most geese in size even though the ganders sometimes weigh over 5kg. They are the best layers.

They are the most active foragers (thus being economical in terms of reduced cost of feeding) and useful as weeders.

They are the most alert and 'talkative' birds

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They produce the leanest meat (with reduced cholesterol levels)
Certain European breeds e.g. Embden and Toulouse have also been used in the tropics with some remarkable success.

Breeding (**Reproduction**)
Female geese may lay for ten (10) years or more in the tropics. They can also lay eggs all year round. Reproduction in geese is usually best in the second year and remains good until the fifth year (Djermanovic, Milojevic and Bozickovic, 2024). Geese has a longer life span (15-20 years) in comparison to other poultry types. The incubation period for eggs in geese is 30-35 days. Females lay about 20-30eggs. Geese are not normally prolific layers. However, certain strains of Chinese breeds produce over 100 eggs/goose/year and at a weight of about 140-170g/egg it compares favourably with the output of laying scavenging chickens. Geese like any other types of poultry are selected for size, prolificacy and vigour. Medium sized birds of breeds make the best breeders. The mating ratio is usually one (1) male to five (5) females. Geese of 2-5 years usually give best mating results. However, a pair (a male and a female) or trio (a male and two females) give the best results providecd ganders (male geese) are kept in pens to prevent fighting. Geese should be mated at least a month prior to the breeding season. Changing mating pairs on yearly basis should be avoided except when they give unpleasant results. When mating birds are changed, previously mated birds should be kept wide apart. Geese do not attain full maturity until they are two years of age. Thus, their reproductive rate is lower in comparison to other poultry types.

Behavioural Pattern
The geese belong to the group of most intelligent birds with good memory (they hardly forget people, animals or even situations that have frightened them). They are able to co-exist peacefully among themselves and other creatures except in overcrowded conditions or when too many males are present in a geese population. Changing of mates is usually not common among geese populations because the bond that exists between male and female is strong.
Geese rest naturally on the ground, however, they show preference for water edge although they readily adapt to man-made resting sites. The gander normally stands as a guard protecting the goose as it incubates its eggs. The gander also helps the goose in rearing the goslings. Geese have been known for their high protective nature which they exhibit when they become irritated particularly when intruders approach their nests or goslings. They attack people and even large dogs. Geese are well adapted to walking and swimming with the aid of their long legs and webbed

toes. Thus, they are able to move long distances if required just to find and consume forage. They have a deep flocking instinct and are easily herded from one area to another. Geese also have a homing instinct, they return home as a flock on their own at the end of the day (at dusk). They have exhibited this character by returning home from a distance up to 5Km. As good swimmers geese are able to swim in water immediately after they hatch from eggs. Inspite of their large size, certain domestic breeds (particularly the leaner types) have been able to retain the ability to fly.

Goose Meat

Native /local geese breeds reared under backyard conditions for the poultry markets are highly valued by consumers (Kirmizibayrak *et. al.* 2011). According to Saatci *et. al.*(2009), geese rearing has been an ancient tradition in Europe and Asia where recently attention has been focused on the meat production capacity of the native / local geese breeds (Dumlu, 2024). Okruszek (2013) defined goose meat as meat type with specific traits of aroma and flavor in comparison to other poultry species. Geldenhuys *et. al.* (2014) evaluated the sensory characteristics of Egyptian goose meat and reported that it had a strong game aroma and flavor and it had low tenderness and juiciness. Kirmizibayrak *et. al.* (2011) observed that meat quality of local poultry breeds produced under traditional conditions are highly valued by consumers. Gogoi *et. al.* (2020) reported nil and negligible odour in geese meat, which may have resulted in higher preference for the meat among consumers. Goose meat has been characterized with low carcass fat, high dressing percentage and good musculature (Narushin, Romanov, Salamon, and Kent, 2023; Okruszek, *et. al.* 2008), low intramuscular fat content, relatively high levels of unsaturated fatty acids and low cholesterol (Buzala, *et. al.,* 2014). It has been documented that meat of geese reared on grassland is high in (PUFA) - polyunsaturated fatty acids (Kozák, 2021). Out of the total poultry meat production statistics of 127.2 million tons the goose along with the guinea-fowl accounted for only 2.6million tons (2%) in 2018 (Kozák, 2021). According to FAOSTAT (2020), 95.9% of goose meat was produced in Asia; 2.4% in Europe and 1.4% in Africa. In the global meat production statistics goose meat is of minor importance in comparison to chicken meat (Dumlu, 2024; Pingel, 2009). Similarly, consumption of goose products (e.g. eggs) have been relatively given minimal recognition in the past, however, in recent decades it has improved tremendously (Indexbox, 2025; Windhorst, 2011). Gooslings (young geese) grow at a very fast rate (NRC, 1991). Intensively managed broiler geese attain slaughter weight/market size of 5kg by 8-9weeks of age; under the semi-intensive system of management they reach slaughter weight of 6kg by 16weeks of age. However, under the extensive system (free range) of management they are slaughtered by 22-

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24weeks of age (Kozák, 2021). In variance to this, NRC, (1991) however reported that geese attain market size at 10-12weeks and are sold at 20-30weeks of age at a weight of 5-7kg depending on the type and breed involved. Intensive geese production system permits a better environmental control even though it increases housing and feed costs.

Dressing Percentage

The dressing percentage depends on the feeding regime of the geese (uptill when they attain maximum growth) and slaughtering time which should not exceed 10 weeks. The amount of fat present in the geese is normally higher in comparison to other poultry meat types. The Chinese and Embden or African breeds normally have low carcass fat. Goose meat is not popular among some people due to its high fat content (Skinner, 1996). Gogoi *et al.*,, (2020) reported a meat to bone ratio of approximately 1:2. Geese have efficient and rapid growth when adequately managed; gooslings can produce one (1) kg body weight for every 2.25-3.5kg of concentrated feed consumed.

Egg Consumption Preference

Goose eggs are mostly used for propagation with occasional consumption in some African countries. Lack of consumption of goose eggs in other regions of the world is due to consumer habits (Kozák, 2021; Boz, Sarıca, Yamak and Erensoy, 2021).

Housing

There is need to provide proper housing units for birds particularly gooslings which are fragile like any other forms of poultry. It is quite necessary to provide gooslings with confinement at night until they attain 6-10weeks of age in order to prevent predator attacks. Geese reared in captivity are usually housed on deep litter like in chickens. They could however be raised on slates or wire mesh, it allows the droppings to pass through the floor and spilled water from the drinkers also pass through. This ensures that the beddings are dry and the risk of parasitic infections is therefore reduced. Geese reared extensively require less care or attention but in very extreme weather conditions for instance in cold places geese may require drinkers, feeders and fencing along with shelters for shade

Marketing Prospects

Gooslings (young goose) grow at a very fast rate and often attain market size at between 10 and 12 weeks even though most goose are sold at 20-30 weeks of age at a weight 5-7kg depending on

the type and breed involved. The market demand for goose meat is mainly with the white-feathered breeds (Huang *et al.*, 2012) because the skin is not discoloured after plucking off the feathers during slaughter. However, in coloured birds the body fluid that leaks out of the quills leads to pigmentation of the skin (Pingel, 2000).

Diseases

- Under poor sanitary conditions salmonellosis affects geese populations and may be transmitted to man through infected meat and eggs
- Coccidiosis and gizzard worm are also common diseases associated with geese production

Limitations to Geese Production

Geese Production is hindered by the following:

- Geese do not attain full maturity until they are two years of age. Thus, their reproduction rate is lower in comparison to other poultry types.
- Salmonellosis, which affects geese populations under poor sanitary conditions could be transmitted to man through infected meats and eggs.
- Coccidiosis and gizzard worm could have devastating effects in geese production systems
- Large number of geese on ponds or along creeks encourages unsanitary conditions, muddy water, hastened bank erosion and destruction of plant life.
- The loud trumpeting of the birds can constitute a nuisance. However, the birds are not aggressive except when they are teased, maltreated or when they are brooding.
- De-feathering in geese is more difficult in comparison to chicken due to the presence of two layers of coats to be removed viz feathers and down feathers.

Research and Conservation Needs for Sustainable Geese Production

Poultry farming researchers globally should carry out studies to explore the potentials of geese farming with the aim of meeting up with the problem of protein food insufficiency, unemployment and poor income situations among resource limited people of rural communities particularly in the third world countries. This can be achieved by:

i. Revisiting and mapping out management practices suitable for tropical husbandry of geese

ii. Mapping out strategies for improved breeding and management techniques towards the genetic selection for specific traits (meats, eggs, growth factors or disease resistance).
iii. Mapping out strategies for improvement of indigenous germplasm and incubation techniques
iv. Carrying out comparative studies on the relative efficiency (especially feed utilization) of the various types of and breeds for specific climate in third world countries Nigeria inclusive.

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Nutrient Profiling of Avocado (*Persea americana*) and African Pear (*Dacryodes edulis*): A Comparative Study for Food and Nutritional Security

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