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Research Article
Endogenous Feeding Practices in Traditional Poultry Production and Local Feed Resources in the Western Plateau Region of Togo

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Abstract

Background and Objective: The profitability of a poultry farm mainly depends on the quality of the feed offered to birds and its cost. This quality of feed is closely linked to feed raw materials. The objective of this study was to inventory the local feed resources that can be used in formulating the diets of poultry in the western plateau region of Togo. **Materials and Methods:** Thus, a survey was carried out in the seven prefectures of the region among 210 farmers chosen on the basis of the importance of their poultry farm and distributed in 35 villages. Direct questions made it possible to collect information on the number of hens reared, the feedstuffs used, their availability during the year, the mixtures of feed made and the frequency of distribution of feed to chickens. **Results:** The results showed that the average number of hens was 121 birds per farmer. Thirty-three local feedstuffs, made up of agricultural products (corn, soybeans, sorghum etc.) and their by-products (corn bran, spent grain from Tchouk, termites etc.) and unconventional resources (Taro leaf, cassava etc.) were identified. The most feedstuffs used were white corn (95.71%), small smoked fish debris (77.14%) and roasted soybeans (70.95%). The majority (87.62%) of farmers mix these feed resources before feeding on average 3 times a day to chicks (67.62%) and 2 times a day to adult chickens (63.81%). **Conclusion:** It can be concluded that the western plateau region of Togo is rich in local feed resources that can be used in traditional poultry feed to reduce feed costs.

Key words: Feeding, local feedstuff, poultry feed, Togo, traditional poultry farming

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Traditional poultry farming remains the most dominant poultry farming system in Togo, accounting for more than 80% of the rural population and mainly comprises hens of local breeds that are well adapted to the conditions of the environment[1]. Togolese consumers appreciate local chicken meat more than broiler chicken, which is considered to be too tender and has a bland taste[2]. Despite its importance, local chicken production faces multiple constraints[3-6], among which feed occupies an important part. Nowadays, improvements in crossbreeding with exotic breeds and introducing new breeds adapted to traditional breeding (Noiler/Goliath and Sasso) would necessitate an increase in feed requirement for satisfactory results. The feed consumed by these chickens is increasingly formulated by imitating the usual practices of commercial poultry farms[7]. The cost of the feed then becomes higher to make the farms of these traditional chickens profitable, hence the need to use local resources in the formulation of rations. Contrary to developed countries which have public and private composition tables based on extensive analyses[8], Togo has very few up-to-date chemical composition data on its local feed raw materials. Thus, foreign tables would often be used for formulation purposes, resulting in imprecise feed formulas and poor zootechnical performance.

However, several local feed resources would exist but the nutritional characteristics and effects on the performance of traditional chickens are unknown. According to Mpouok[8], only a reasonable control of the quality of the raw materials makes it possible to combine them, taking into account the physiological requirements of the poultry and the desired performances, to obtain an economically viable feed. The future development of commercial poultry production depends on the availability and perfect knowledge of the nutritional values of the available raw materials Mpouok[8] in order to develop the feed cost share (50-70%) optimally[9]. The aim of this study was, on the one hand, to investigate the traditional poultry feeding and on the other hand, to highlight the local feed resources used in the diet of poultry in western plateau region of Togo.

MATERIALS AND METHODS

Study zone: Located between 6°31 and 8°22 north latitude and 0°32 and 1°38 east longitude, the plateau region is bounded in the north by the central region, to the south by the maritime region, to the east by the Republic of Benin and to the west by the Republic of Ghana. The plateau region is the largest in the country, with an area of 16.800 km^2 and a population of 1.375.165 inhabitants, including 696.974 women[10]. The physical setting of the plateau region is marked by an opposition between the mountainous west where the Atakora chain, made up of the Akebou, Akposso and Danyi plateau, dominates the Litimé plain to the east where the vast plain spreads Precambrian covering more than two-thirds of the regional surface. Due to its contrasting and varied relief, the plateau region benefits from a relatively nuanced climate ranging from medium altitude subequatorial (cool plateau) to transitional equatorial and humid tropical climates (climate of the Precambrian peneplain). Four main hydrographic basins drain this region: The Volta, Mono, Zio and Haho basins. It is one of the most important regions in traditional poultry production. In 2015 it was the largest producer of local poultry, with a workforce of 5.494.471 heads[11]. It is subdivided into two agricultural regions: the Est plateau region and the western plateau region. This study took place in the western plateau region of Togo, made up of seven prefectures, namely Agou, Kloto, Kpele, Danyi, Amou, Wawa and Akebou (Fig. 1).

Sampling of farmers: The survey for the identification of feeding practices in traditional poultry farming and local feed resources to be used in poultry feed was conducted among 210 farmers in villages in the prefectures of the western plateau region.

The region was chosen based on the number of chickens produced locally. Five villages were chosen per prefecture according to the existence of a commercial farmer and the importance of poultry farming in the area, totaling 35 villages surveyed. Six (06) farmers were randomly selected in each village based on their receptivity and the importance of their production.

The choice of villages and farmers was made with the support of Heads of agencies, Senior Technicians and ICAT Advisors in the region.

Development and administration of the questionnaire: The survey was carried out from August 3-6 and December 1-5, 2021. A structured questionnaire was administered to the respondents to elicit information that captured the study's objectives using a survey sheet (interview guide). The funnel-shaped questionnaire was developed starting from general questions on the respondents' location and personal information (identity) to specific questions related to the objectives of the survey.

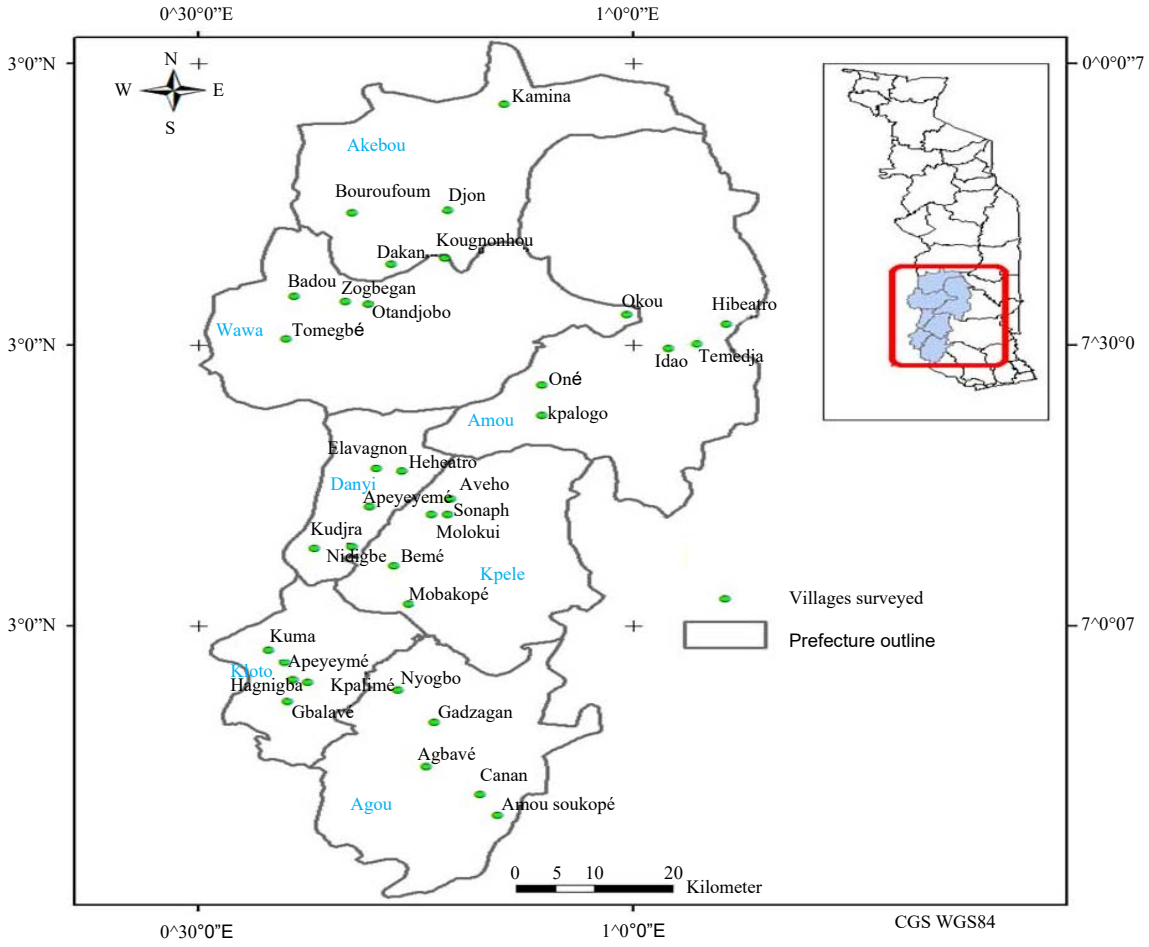

Fig. 1: Map locating the villages surveyed in the seven prefectures of the western plateau region of Togo*

The specific questions mainly concerned:

- Breeding poultry species and other animal species
- Number of birds reared
- Feed resources distributed by the farmer to the birds at the young (chick) and the adult stage
- Reasons for using a category of feed resources at a given stage of growth
- Availability of feed resources during the year in the area
- Daily frequencies of feed distribution to the poultry
- Different feed mixtures made by the farmer
- Distribution of water to poultry

Before the survey, the questionnaire was tested in a pilot study with five farmers at Avétonou village to improve its structure, arrangement and clarity.

The farmers from each village were brought together in their usual meeting place with the help of the ICAT advisers. They were engaged individually to answer questions. The specific questions were addressed after a brief introduction mentioning the objective of the survey, the interest of the farmer's results and the approximate interview duration. The geographical coordinates of the meeting place were noted on the survey sheet. Some farmers who could not make the trip to the meeting place were contacted and questioned at homes.

Before the day of the interview, the farmers were asked to bring samples of the raw material they used to the meeting places.

Data collection and analysis: Data was collected using the survey form developed for this purpose.

The data collected were:

- The socio-demographic characteristics of farmers: identity, marital status, ethnicity, sex, primary and secondary activity, species of poultry raised and the number of hens raised
- The Feed resources used in poultry feed and their availability during the year
- The Poultry feeding: Distribution of feed to poultry, distribution of water to poultry, number of daily distributions, the mixture of feed

The geographical coordinates of each surveyed village were reported on a map.

The data were analyzed using the software STATA version 16.0. The descriptive statistics was used to highlight the frequencies and the Chi-square test was performed at the 5% threshold to establish the relationships between certain variables.

RESULTS

Sociodemographic characteristics of farmers: Of the 210 farmers surveyed, 72 were women, corresponding to 34.29%. Information on marital status revealed only two types of farmers: married or widowed. Most farmers surveyed were married (99.05%) against 0.95% of widowers. The western plateau region of Togo is ethnically diverse. Eleven ethnic groups were identified in the seven prefectures of this region (Fig. 2). The largest ethnic group in terms of numbers was the Ewe (58.1%), followed by the Kabyè (22.38%).

The activities that occupied the daily life of the farmers surveyed were agriculture, livestock, trade, computer maintenance, health worker, education, sewing, hairdressing but chery and carpentry. All these activities constituted either the main profession of the farmer (Table 1) or the secondary profession (Table 2). It was noted that agriculture was the main activity (73.33%) of the respondents, while livestock farming was the secondary activity (83.33%) of these respondents.

Poultry species and number of hens reared: The study showed that the hens produced in this prefecture was either pure (hens only) or in association with other poultry. Indeed, most poultry farmers surveyed (68.1%) raised hens alone in their poultry house or farmyard against 31.9% who raised hens associated with other poultry species. Poultry species other than hens produced by these farmers were turkeys, guinea fowl, ducks and pigeons.

Table 1: Main activities of farmers surveyed in the western plateau region of Togo

Main activity	Frequency	Percentage
Agriculture	154	73.3
Breeding	31	14.8
Other activity[1]	25	11.9
Total	210	100

[1]Commerce, computer maintenance, health worker, education, sewing, hairdressing but chery and carpentry

Table 2: Secondary activities of farmers surveyed in the western plateau region of Togo

Secondary activity	Frequency	Percentage
Breeding	175	83.30
Agriculture	33	15.70
Other activity	2	0.952
Total	210	1000

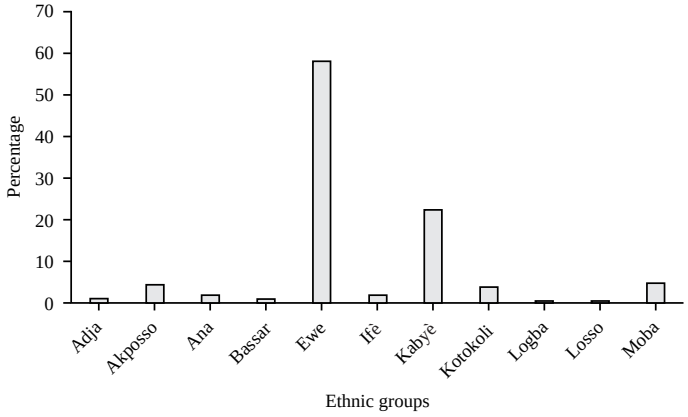

Fig. 2: Ethnic profile of farmers in the western plateau region of Togo

Table 3: Number of hens reared per poultry farmer and per gender

Sex	Farmers	Average No.	Minimum	Maximum
F	72	55.7±66.1	5	504
M	138	156.0±605	6	5000
Total	210	121.0±494	5	5000

Table 4: Raw materials used in the seven prefectures of the western plateau region of Togo

Raw material	Abundance time
White corn	August-January
Corn bran	August-January
Rice bran	December-March
Cubed bran	January-December
Small fish debris	January-December
Roasted soy	November-January
Dried cassava	January-December
Sorghum	November-March
Six-month millet	October-January
Soybean spent grain	January-December
Leucaena leaf	January-December
Moringa leaf	January-December
Termites	March-November
Paddy rice	December-March

The breeds of hens that were raised consisted not only of the traditional (local) breed but also of the improved and imported traditional breed (Noiler, Goliath and Sasso).

The number of hens raised per poultry farmer were between 5 and 5000 birds (Table 3).

Feed resources used in poultry feed in the western plateau of Togo: The feed resources used in poultry feed in the western plateau region of Togo were diversified, ranging from conventional raw materials (corn, soybeans, etc.) to artisanal processing by-products and unconventional raw materials such as leaves. Moringa and Leucaena, termites, Tchouk spent grain (local drink made from sorghum), soy spent grain (Okara), baobab leaf, corn spent grain, taro leaf, cassava leaf and red oil were used. A total of 38 resources have been identified, 33 of which were local raw materials.

Availability of the raw materials: The raw materials were available locally or in the market but the quantities (abundance) varied depending on the time of the year. Not all raw materials were available at the same time in the seven prefectures of the region. Some were found in all seven prefectures, while others were only found in one prefecture (Table 4-6).

Use of raw materials: Feed resources were used differently depending on the farming area. The frequency of use varied according to the department (Table 7-9)

Table 5: Raw materials used in 6, 5 and 4 departments of the western plateau region of Togo

Raw material	No. of departments	Abundance time
Yellow corn	6	August-January
Oyster shell	6	January-December
Tchouk's spent grain	6	January-December
Palm kernel meal	6	January-December
Local soybean meal	5	January-December
Snail shell	4	January-December
Taro leaf	4	January-December
Salt	4	January-December
Concentrate (meat/egg)	4	January-December

Table 6: Raw materials used in 3, 2 and 1 departments of the western plateau region of Togo

Raw material	No. of departments	Abundance time
Rice balls	3	December-March
Three-month millet	3	July-October
Cottonseed meal	3	January-December
Calcined bone meal	2	January-December
Corn spent grain	2	January-December
Purple corn	2	August-January
Cowpea	2	November-January
Gliricidia leaf	1	January-December
baobab leaf	1	January-December
Sweet potato root	1	September-December
Peanut meal	1	January-December
Palm oil	1	January-December
Peanut leaf	1	January-December
Cassava leaf	1	January-December
Sugar	1	January-December

Most of the feed resources used in chicken farming and identified in the western plateau region of Togo were produced locally (Fig. 3). The most widely used were white corn (95.71%), small smoked fish debris (77.14%) and roasted soybeans (70.95%).

Feed and water distribution: All the farmers surveyed offered feed and water to their poultry. The feed was offered in wooden or galvanized sheet feeders in the hollows of the split bamboos. The daily frequency of feed distribution was 3-4 times for chicks and 2-3 times for adult chickens (Table 10). In the prefecture of Kloto, the majority of the farmers (56.67%) distributed feed 4 times to chicks. In the prefecture of Danyi, majority of farmers (53.33%) fed adult chickens 3 times a day.

Throughout the region, the feed was mainly distributed 3 times a day to chicks (67.62%) and 2 times a day to adult chickens (63.81%). Water was distributed *ad libitum* in plastic drinkers or cans.

Different combinations of raw materials at farmers: Results showed that in the seven prefectures of the western plateau region of Togo, most farmers (87.62%) mix feed before distributing it to poultry (Fig. 4). Mixed feed is fed to both chicks and adult chickens. It is only the frequency of

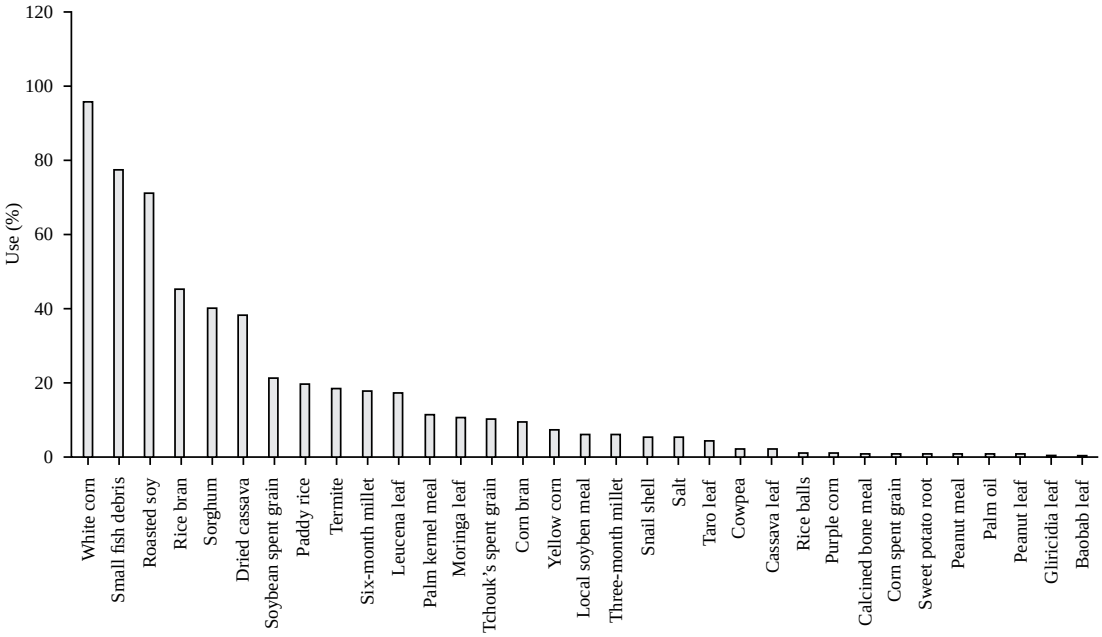

Fig. 3: Local feed resources and their intensity of use in the western plateau region of Togo

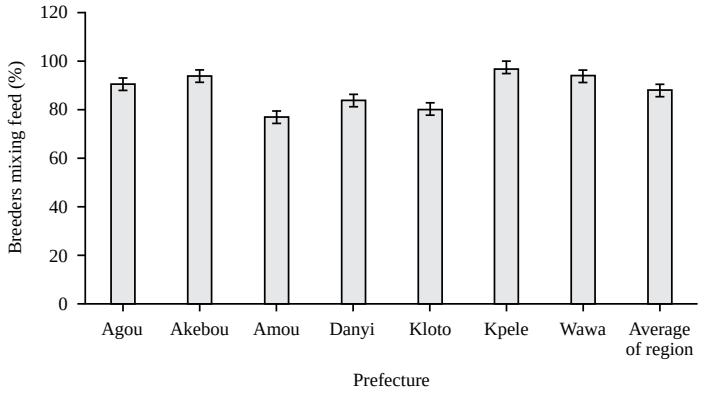

Fig. 4: Percentage of farmers mixing feed according to the departments

distribution and the quantities that differ. Raw materials were ground separately before being mixed and distributed to chickens. Different combinations of raw materials were made according to their availability. These combinations ranged from two to ten raw materials. The most common combinations were cereals (maize, millet, sorghum), soybeans and small smoked fish debris. With these three, some farmers combined snail, oyster shell or calcined bone meal.

Depending on the main activity, 80.65-96% of farmers mixed feed (Fig. 5). Based on the chi-square test, the feed mixture was not dependent on the main activity of the farmer ($p = 0.22$).

DISCUSSION

The results of the survey revealed that in the western plateau region of Togo, women occupied a significant place (34.29%). This proportion of the farmers in traditional poultry farming is much higher than the data (60,678 women out of 403,372 poultry farmers, i.e. 15.04%) obtained during the fourth national census of agriculture in 2013[12]. Similar results were reported in Côte d'Ivoire where 41% of poultry farmers were women[13]. Women in rural areas of the western plateau region of Togo are therefore not on the sidelines of poultry

activities as it was their main source of income. This situation can be explained by the fact that financially, women no longer want to be dependent on their husbands and are therefore more active than ever before.

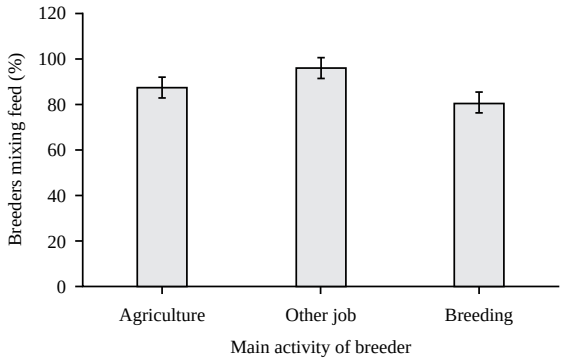

Fig. 5: Percentage of farmers mixing feed according to the main activity

Information on the marital status in this study revealed that the majority of farmers surveyed were married (99.05%) contrary to the results of the 4th national census of agriculture in 2013[12] which showed that the married people in the region was 31.4%. A large number of men are required to ensure the regular maintenance of the henhouses, the feeding and watering of the poultry before going about other activities. Only a complete household (father, mother and children) could make it possible to be an excellent traditional poultry farmer with large numbers of poultry. Most of the farmers surveyed reported that they took care of birds with the support of the wife or husband and children.

Among the eleven ethnic groups identified, the largest in terms of numbers was the Ewe, (58.1%) followed by the Kabyè (22.38%). This dominance of the Ewe ethnic group could be justified by the fact that the plateau region constituted the territory of the people who occupy the south of the country[14].

Table 7: Frequency of use of MP available in the seven department of the western plateau region of Togo

	Frequency per department (%)								
Raw material	Agou	Akebou	Amou	Danyi	Kloto	Kpele	Wawa	Average per region (%)	Prob. χ^2
White corn	90.00	96.7	96.7	93.3	96.7	100	96.7	95.7±3.18	0.621
Corn bran	3.33	6.67	6.67	10.0	10.0	3.33	26.7	9.52±8.05	0.036*
Rice bran	60.00	26.7	36.7	60.0	43.3	36.7	53.3	45.2±12.9	0.621
Cubed bran	30.00	3.33	10.0	40.0	43.3	13.3	40.0	25.7±16.5	0.000*
Fish debris	86.70	80.0	60.0	60.0	76.7	90.0	86.7	77.1±12.5	0.014*
Roasted soy	86.70	50.0	43.3	73.3	83.3	76.7	83.3	70.9±17.3	0.000*
Dried cassava	46.70	33.3	20.0	30.0	30.0	53.3	53.3	38.1±13.0	0.044*
Sorghum	20.00	36.7	66.7	53.3	13.3	53.3	36.7	40.0±19.2	0.000*
Six-month millet	10.00	16.7	10.0	30.0	16.7	26.7	16.7	18.1±7.67	0.309
Soybean spent grain	6.67	40.0	23.3	30.0	3.33	30.0	16.7	21.4±13.3	0.004*
Leucaena leaf	20.00	6.67	20.0	20.0	10.0	20.0	26.7	17.6±6.87	0.441
Moringa leaf	20.00	13.3	16.7	10.0	10.0	3.33	3.33	10.9±6.30	0.292
Termites	6.67	36.7	30.0	20.0	16.7	3.33	16.7	18.6±11.8	0.010*
Paddy rice	6.67	33.3	40.0	23.3	10.0	16.7	10.0	20.0±12.8	0.005*

Prob.: Probability, *Significant (the use of the MP is linked to the farmer's department), a probability value of 0.05 was retained as the degree of significance

Table 8: Frequency of use of MP present in 6, 5 and 4 prefectures of the western plateau region of Togo

	Frequency per department (%)								
Raw material	Agou	Akebou	Amou	Danyi	Kloto	Kpele	Wawa	Average per region (%)	Prob. χ^2
Yellow corn	13.30	10.00	6.67	0.00	10.00	10.0	3.33	7.62±4.59	0.492
Oyster shell	20.00	0.00	13.30	20.00	43.30	6.67	13.3	16.7±13.7	0.000*
Tchouk's spent grain	3.33	20.00	20.00	16.70	3.33	0.00	10.0	10.5±8.49	0.032*
Palm kernel meal	10.00	0.00	6.67	13.30	33.30	3.33	13.3	11.4±10.8	0.002*
Local soybean meal	3.33	0.00	0.00	3.33	16.70	6.67	13.3	6.19±6.51	0.041*
Snail shell	10.00	6.67	0.00	3.33	0.00	0.00	20.0	5.71±7.38	0.006*
Taro leaf	0.00	3.33	0.00	23.30	3.33	0.00	3.33	4.76±8.35	0.000*
Salt	6.67	0.00	10.00	16.70	0.00	0.00	3.33	5.24±6.35	0.024*
Concentrate (meat/egg)	3.33	0.00	0.00	6.67	3.33	0.00	13.3	3.81±4.87	0.069

Av.: Average, Prob.: Probability, *Significant (the use of the MP is linked to the farmer's department), a probability value of 0.05 was retained as the degree of significance

Table 9. Frequency of use of MPs present in 3, 2 and 1 department of the western plateau region of Togo

	Frequency per department (%)								
Raw material	Agou	Akebou	Amou	Danyi	Kloto	Kpele	Wawa	Average per region (%)	Prob. χ^2
Rice balls	0.000	0.000	3.33	3.33	0.00	0.00	3.33	1.430±1.78	0.669
Three-month millet	0.000	0.000	0.00	10.00	16.70	16.7	0.000	6.190±8.05	0.003*
Cottonseed meal	3.330	0.000	0.00	3.33	0.00	3.33	0.000	1.430±1.78	0.669
Calcined bone meal	0.000	3.330	0.00	3.33	0.00	0.00	0.000	0.952±1.62	0.538
Corn spent grain	3.330	3.330	0.00	0.00	0.00	0.00	0.000	0.952±1.62	0.538
Purple corn	0.000	0.000	0.00	10.00	0.00	0.00	0.000	1.430±3.78	0.006*
Cowpea	0.000	10.000	6.67	0.00	0.00	0.00	0.000	2.380±4.18	0.035*
Gliricidia leaf	0.000	3.330	0.00	0.00	0.00	0.00	0.00	0.476±1.26	0.420
Baobab leaf	3.330	0.000	0.00	0.00	0.00	0.00	0.000	0.476±1.26	0.420
Sweet potato root	0.000	0.000	6.67	0.00	0.00	0.00	0.000	0.952±2.52	0.059
Peanut meal	0.000	6.670	0.00	0.00	0.00	0.00	0.000	0.952±2.52	0.059
Palm oil	3.330	0.000	0.00	3.33	0.00	0.00	0.000	0.952±1.62	0.538
Peanut leaf	0.000	0.000	3.33	3.33	0.00	0.00	0.000	0.952±1.62	0.538
Cassava leaf	0.000	0.000	3.33	13.30	0.00	0.00	0.000	2.380±4.99	0.004*
Sugar	0.000	0.000	0.00	3.33	0.00	0.00	0.000	0.476±1.26	0.420

Av.: Average, Prob.: Probability,*Significant (the use of the MP is linked to the farmer's department) and a probability value of 0.05 was retained as the degree of significance

Table 10: Percentage of farmers by daily frequency of feed distribution

	Farmers Percentage			
	Chick		Adult chickens	
Departments	3 times	4 times	2 times	3 times
Akebou	80.0	20.0	73.3	26.7
Wawa	80.0	20.0	63.3	36.7
Amou	63.3	36.7	56.7	43.3
Danyi	73.3	26.7	46.7	53.3
Kpele	80.0	20.0	70.0	30.0
Kloto	43.3	56.7	73.3	26.6
Agou	53.3	46.7	63.3	36.7
Average	67.6±14.8	32.4±14.8	63.8±9.68	36.2±9.70

The main activity of farmers in the western plateau region of Togo was agriculture (73.33%) and livestock farming was the secondary activity (83.33%). According to the 4th RNA in 2013[12], agriculture is the main activity of the majority (81%) of the rural Togolese. The same is true for the dominant secondary activity, which accounted for more than a third of the agricultural population, i.e. 34%[12], Although, the proportion we noted in this study was higher (83.33%).

The poultry species encountered during our survey included hens, guinea fowl, turkeys, ducks and pigeons. The same species were listed by FAO in 2015 FAO[12] with a combination of ducks and geese.

The average number of hens reared was 121 birds per farmer, with a minimum of 5 birds and a maximum of 5000 birds. This average number is much higher than that obtained during the 4th RNA in 2013[12], where the average number was 30 poultry per farm. This indicates a good evolution of traditional Togolese poultry farming. This result is supported by FAO surveys FAO[15] which showed that the percentage of farmers with more than 20 birds is greater (42%) than that of farmers with 1-5 heads (9%). This evolving situation could be due to the multifaceted support of the PASA (Agricultural Sector Support Project) and PPAAO (Agricultural Productivity Program in West Africa) projects in financial terms (granting of loans for the construction of henhouses and acquisition breeding equipment) and techniques (training of farmers). It could also be due to the introduction of new, improved traditional breeds of poultry, such as the Sasso and the Noiler/Goliath, which have a better weight than the local breed[16] and are more resistant than the exotic breeds. As day-old chicks of these breeds are available, it is easier for farmers to source large numbers for flock breeding; this is the case for most of the farmers surveyed who have large numbers of up to 5,000 heads.

The small number of animals noted among some farmers during our surveys can be attributed to the fact that farmers sold adult animals in August to meet their children's schooling needs and in December to meet Christmas holiday expenses. Results showed that in addition to feed crops, traditional farmers used a large number of unconventional raw materials

(Termites, Corn bran, Leucaena leaf, Moringa leaf, Glyricidia, baobab, groundnut, cassava and taro). Some authors have also reported the use of different types of unconventional raw materials such as: leaves of *Leucaena leucocefala*[17], leaves of *Moringa oleifera*[18,19], termites[20-23], Okara or soybean spent grain[24,25].

Conventional feedstuffs from crops are abundant from August to January (maize and its by-products) and from November to January (sorghum, millet, soybeans, rice and their by-products). Therefore, this period of abundance is justified because it corresponds to the harvest periods for these agricultural products[15]. Since cassava does not have a fixed harvest period, it is available throughout the year. However, some farmers mentioned that a period of abundance of fresh cassava is linked to the rainy season because the soil being wet, facilitates the uprooting of the tubers.

On the other hand, agro-industrial by-products (cakes, spent grains, shells and concentrates), small smoked fish debris and certain unconventional raw materials (Leucaena leaf, Moringa leaf, Glyricidia leaf, baobab leaf, groundnuts, cassava and taro), are available all year round.

The availability of unconventional raw materials such as cowpea (November to January) and sweet potato (September to December) are also linked to the harvest period. Termites, on the other hand (March to November), are linked to the rainy season.

The Chi-square test showed that the use of raw materials such as corn bran, Cubed bran, Debris of small smoked fish, roasted soybeans, fresh or dried cassava, sorghum, soybean spent grain, termite, paddy rice, oyster shell, tchouk spent grain, palm kernel meal, local soybean meal, snail shell, taro leaf, 3-month-old millet, salt, purple corn, cowpea and cassava leaf, is dependent on the prefecture ($p<0.05$). The latter are therefore available and well known for being suitable for poultry feed in the prefectures where they are used. They would also positively affect the health and performance of poultry, which justifies their use by farmers.

Raw materials such as maize bran, cubed bran, small smoked fish scraps, roasted soybeans, fresh or dried cassava, sorghum, soybean spent grains, termites and paddy rice were used in all prefectures of the western plateau region of Togo. They are therefore well known to farmers, available and accessible to them.

The distribution of feed 3 times a day to chicks and 2 times a day to adult chickens shows that traditional poultry farmers in the western plateau region of Togo have reached a fairly high technical level, allowing them to maintain their animals for better profitability. According to the farmers, the distribution of feed to the chicks are done twice in the morning (on waking and around 9 a.m.) and once in the afternoon before sunset. Farmers who distributed feed 4 times a day make two distributions in the morning and two in the afternoon. This result agrees with the findings of Batimsoga *et al.*[26] who reported that distribution of feed to local chicks from 6 a.m. to 12 p.m. and from 2-6 p.m. is more effective.

Regardless of the equipment used, water was distributed at will to all farmers, which means that they are aware of the importance of the constant availability of water for animals according to their needs.

According to the results of the survey, the majority of farmers mixed the feed before distributing it to the chickens. Poultry feed in traditional farming has evolved from simple distribution of cereal grains in isolation to a combination of several crushed, crushed or pounded raw materials. Farmers, therefore, know that the combination of raw materials allows a good coverage of poultry needs to obtain better performance. Combining cereal, soybeans and small smoked fish debris by the farmers also shows that they were not only aware of the value of combining feedstuff but also knew the specific animal nutritional requirements for each food.

A large number of raw materials used in the diet of poultry in traditional farming have been identified during our study. According to the farmers, they have beneficial effects on the performance of the hens and no harmful effects on their health. In particular, we noticed the use of small smoked fish debris instead of commercial fishmeal[9], local palm kernel cake and local soybean cake. The nutritional values of these raw materials remain to be determined because they would be very different from those in the market (imported). The same is true for purple maize, okara (soybean spent grains), three and six-month-old millet, which could have very interesting nutritional values for poultry feed but significantly different from the values found in the literature. This is the example of the protein and energy values of millet[8,27] which are generalized while preliminary bromatological analysis have revealed that there are two varieties in Togo (3-month and 6 months old) with very different values from each other and which would justify the use of early millet (3-month-old millet) at the start by rural livestock farmers[9].

CONCLUSION

Feed remains the Gordian knot in poultry farming, whether traditional or modern. For better profitability, particular emphasis should be placed on it. It was found that in the western plateau region of Togo, there are numerous

local feed resources (33) ranging from agricultural products to non-conventional resources. The most commonly used are white corn, small smoked fish fragments and roasted soybeans. The abundance of these raw materials is linked to the rainy season but they are all available throughout the year. The majority of farmers use different combinations (mixes) of several raw materials to make rations that are distributed to both chicks and adult chickens. The most used mixtures are those of cereals (maize, millet, sorghum) plus soya and small smoked fish debris. The number of hens recorded were on average 121 birds per farmer, showing that the feed resources used were effective in improving poultry performance. To formulate less expensive rations, it is crucial to establish a repository of local feed resources by analyzing them at a bromatological level in order to ensure the profitability and sustainability of the poultry sector in Togo.

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