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Biosecurity in poultry farms in peri-urban areas of Brazzaville

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Abstract : Purpose :*The main objective of this study was to contribute to a better knowledge of the respect of the application of unfamiliar biosecurity measures for the improvement of the productivity of poultry farms in peri-urban areas of Brazzaville. The study was conducted on a sample of 42 poultry farms.*
Methodology:*The methodology applied is based on surveys and interviews with farmers, supported by direct observations.*
Results :*The biosecurity measures analyzed pertained to the remoteness, the flow and sanitation. Regarding the management of corpses, 98 percent of poultry farmers buried corpses in the ground against 2% that incinerate; 81% of technical staff are in contact with other farms compared to 19% who are not. As for sanitation, 60% of poultry farmers do not practice the fight against pest. In the prevention of diseases and the implementation of immune memory in 98% of farms poultry do not practice vaccination.*
Conclusion : *The observance of biosecurity measures in the poultry farms qualified intermediary as some measures are well observed by poultry farmers, however others are less so, which exposes the farms at risk sanitary facilities. In view of the results obtained, the observance of biosecurity measures in the poultry farms must be rigorous.*
Keywords :*Biosecurity-removal-sanitation-flow-poultry - Congo.*

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I. Introduction

Biosecurity is a public health problem. Controlling health in poultry farming is one of the major challenges. A good health level is often the guarantor of good technical and economic results. On the other hand, a sanitary imbalance in poultry farming can lead to immediate consequences such as the drop in productivity due to any pathology. Indeed, the measures against the spread of diseases can be taken to preserve the animals and the humans who handle them. Nowadays these measures are summed up in a concept called biosecurity.

According to Saegerman (2012) in the field of animal health, the definition of biosecurity can be very broad with five components: 1-Bio-exclusion: the pathogen does not enter a herd; 2- Bio-compartmentalization: thepathogen does not circulate in a herd; 3- Bio-confinement: the pathogen does not leave a herd; 4 - Bio-prevention: the pathogen does not infect humans; 5 - Bio-contamination: the pathogen does not persist in the environment.

In Congo, biosecurity is still poorly understood by livestock farmers and public authorities. The livestock sector still marginal in the Congolese economy makes the task more difficult and actions in the sector are still to be desired. As a result, Congo remains one of the world's leading importers of meat products to cover the needs of the population. It spends more than 200 billion FCFA each year for the supply of products of animal origin (NIANG, 2017).

Facing such an uncomfortable situation, the will of the Congolese State is to make livestock a basic productive sector capable of rehabilitating its creative capacity, enhancing its employment potential and its ability to contribute to state revenues. In such a dynamic, the development of 5 sectors of livestock farming is a priority: poultry, small ruminants, cattle, pork and non-conventional breeding (FAO-MAE, 2009).

Poultry farming is a growing sector in all developing countries and the Congo. Unfortunately in the Congo, it is confronted with the obsevance of biosafety measures that hinder poultry productivity.

Given the importance of poultry farming in Congo, it is necessary to take stock of biosecurity in poultry farms in peri-urban areas of Brazzaville and to see to what extent the application of good farming practice biosecurity could improve the health status of poultry flocks and their productivity.

The general objective of this study is to contribute to a better knowledge of the respect of the application by the farms of the poultry farms in the peri-urban areas of Brazzaville of poorly known biosafe measures in order to improve the productivity of the poultry farms. in peri-urban areas of Brazzaville.

The following specific objectives have led to this study:

- to analyze the profile of poultry farms and livestock systems in poultry farms in peri-urban areas of Brazzaville
- analyze the level of application of biosafety measures related to remoteness, flow control and sanitation;
- estimate the biosecurity rate in poultry farms in peri-urban areas of Brazzaville.

II. Material And Method

2.1. Location and sample of the study

The study took place on the outskirts of the city of Brazzaville, capital of the Republic of Congo. The city has nine (9) administrative districts grouped into five (5) agricultural sectors (DGE, 2017). This is sector 1 DJIRI, sector 2 TALANGAI comprising TALANGAI, OUENZE and POTO-POTO, sector 3 M'FILOU including M'FILOU and MOUNGALI, sector 4, MAKELEKELE including MAKELEKELE and BACONGO and sector 5 MADIBOU.

The study focused on 42 semi-intensive or battery farms and litter farms (Figure 1a and 1b), of which 8 belonging to sector 1 DJIRI, 2 to sector 2 TALANGAÏ, 7 sector 3 M'FILOU, 8 sector 4, MAKELEKELE and 17 at sector 5 MADIBOU. The study took place over a period of 3 months.

2.2. Breeding system

In the Congo, as in most African countries, poultry farming is an activity practiced by populations in both rural and peri-urban areas. The observation of poultry production systems shows the existence of two types of poultry farming: intensive poultry farming exclusively using improved breeds that produce either meat or eggs and traditional or village poultry farming whose characteristics are: restricted herd, an extensive type of farming with a minimum of inputs and a low yield (AKOUANGO, 2004).

2.3. Studied parameters

The main were : farmers profile, breeding system, observance of biosecurity measures and biosecurity rate.

2.4. Methods used

All data collection was possible thanks to the semi-directive, collective interviews and direct observations on the farms.

2.4.1. Observance of biosecurity measures related to remoteness

The observance ofbiosecurity measures related to remoteness is essential and must be applied to prevent or limit the introduction of new infectious agents into a poultry farmOULON, (2010).

The distance is based on two types of notions including: bioexclusion and biocontainment.

Regarding bioexclusion, it was a question of examining how the breeders put into practice the measures that prevented the penetration of microbes in the farms.

As for biocontainment, we looked at the measures preventing the release of microbes from the herd to prevent the spread of microbes.

For this, our attention was focused on the management of corpses, the protection of buildings, control and traceability of food.

2.4.2. Observance of biosecurity measures related to flow control

Regarding the observation of biosecurity measures related to the control of flows, our attention is focused on the traceability of the examination of different animal health registers and neighborhood contacts.

2.4.3. Observance of biosecurity measures related to sanitation

Sanitation has two stages: cleaning and disinfection (ALLOUI, 2003).

By direct observation, we examined the state of cleanliness of farms, livestock equipment, and herds.

Disinfection is the finishing step after cleaning in the sanitation principle (ECOCERT, 2010).

Vaccination as a means of preventing disease by introducing an immune memory in poultry also enters the sanitation practice (AKOUANGO et al., 2013).

The method also consisted in observing the practice of vaccination and the fight against pests carried out within the farms.

2.4.4. Biosecurity rate

The biosecurity rate is the ratio of the number of points obtained by farmers on the total points of the grid of key factors to be analyzed expressed as a percentage.

It is calculated by the formula below (RACICOT and VAILLANCOURT, 2009):

Biosecurity rate (Tb) = (Number of points obtained per farmer) / (Total points in the grid of key factors to be analyzed) X 100

The observed compliance was compared to the reference table (Chart1) set up by the same authors.

2.5. Statistical analyzes

The information contained in the questionnaire was entered on the Microsoft Office Excel 2010 Spreadsheet. The data processing consisted of validating the data matrix by searching for and correcting outliers as well as the incorrectly entered information.

It provided descriptive statistics, including averages and frequency of responses. It also allowed to establish graphical representations of the variables studied. The constituted matrix was exported under the Sphinx version 5 software to first apply the nonparametric Pearson homogeneity chi - square test. The analysis of variance combining the average comparison on the threshold of 5% was applied.

The analysis also consisted in applying the biosafety assessment grid by assigning one (1) point per observance of each of the biosecurity measures by the evaluated farms. The points affected concern the application of the three basic biosafety principles (remoteness, flow control and sanitation) and do not exceed 40 points. Thus the biosecurity rate was estimated by poultry exploitation.

III. Results

3.1. Profile of poultry farmers

Poultry farming in the peri-urban areas of Brazzaville mobilizes both men and women (Figure 2). The results of surveys of poultry farms show that men (74%) practice more poultry than women (26%).

The difference between these two categories of poultry farmers is very significant ($\chi^2 = 9.52$; $p = 0.002$; $p < 0.05$).

Figure 3 illustrates that the number of poultry farms increases with the level of education. The numbers are decreasing among academics (50%) to poultry farmers with a primary level (4.76%). The chi-square test confirms the existence of a very significant difference between these levels of education ($\chi^2 = 19.90$; $p = 0.0002$; $p< 0.05$).

3.2. Breeding system

The study concerned only the semi-intensive breeding system where the observance of biosafety measures could be better appreciated. The study shows that battery and bedding systems are found in peri-urban areas of Brazzaville.

The mode of breeding on litter represents 92.68% against 7.32% for that in battery (Figure 4). The difference is very significant between these two farming methods ($\chi^2 = 65.02$; $p = 0.0001$; $p< 0.05$).

3.3. Observance of biosecurity measures related to remoteness

The biosecurity related to remoteness in the surveyed farms focused on the management of corpses, the protection of buildings and the control of food.

In the poultry farms surveyed, the poultry farmers bury the corpses in the soil (98%) and 2% cremate the corpses. The difference between these two categories of poultry farmers is very significant ($\chi^2 = 38.10$; $p = 0.0001$; $p< 0.05$).

The survey has shown that the majority of poultry farmers have 83,33% fenced buildings, compared with 16.67% of non-fenced farms. The difference between these two categories of farms is very highly significant($\chi^2 = 18.67$; $p = 0.0001$; $p< 0.05$).

Food quality control is needed to ensure a high level of biosecurity not just annually, but daily. This practice is applied at 4.88% against 95.12% who do not apply. The difference between these two categories is very significant ($\chi^2 = 33.39$; $p = 0.0001$; $p< 0.05$).

The majority poultry farmers in the survey (54%) observe the measure of the inaccessibility of the pests on the food, against 46% who do not observe. The difference between these two categories is not significant($\chi^2 = 1.52$; $p = 0.0217$; $p > 0.05$).

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3.4 Observance ofbiosecurity measures related to flow control

The biosecurity assessment of poultry farms focused on the biosecurity of traceability, contacts and neighborhood.

The observance ofrecord keeping is considered average, almost half of poultry farmers do not have records of animal entry and exit.

Keeping records of veterinary examinations is observed by 24% of poultry farmers against 76% who do not observe. The difference between these two categories is very significant ($\chi^2 = 11.52$; $p = 0.0007$; $p < 0.05$)

The observance of the register of mortalities is recorded by 48% of farmers, against 52% of poultry farmers who do not observe it. The difference between these two categories is not significant($\chi^2 = 0.10$; $p = 0.7576$; $p > 0.05$).

Poultry farmers who keep a medical register with care administration account for 67% of all poultry farmers surveyed against 33% of poultry farmers. The difference between these two categories is very significant ($\chi^2 = 4.67$; $p = 0.0008$; $p < 0.05$).

The observance of the keeping of the visitor register by poultry farmers represents only 16.67% of poultry farmers surveyed. The difference between these two categories is very significant significative ($\chi^2 = 18.67$; $p = 0.0001$; $p < 0.05$).

Contact and neighborhood biosecurity takes into account several factors such as : the source of poultry, feed suppliers, farm staff, contact of poultry with wild animals, including wild birds, etc. All of these factors relate to contact and neighborhood that can promote inter-contamination between different places (food factories, pharmacies, neighboring farms, etc.).

The study showed that 88% of poultry farmers know the origin of their poultry; only 12% do not know where their poultry comes from. The difference between these two categories is very significant ($\chi^2 = 24.38$; $p = 0.0001$; $p < 0.05$). This lack of knowledge about the origin of poultry can present a weakness in the fight against pathologies.

The survey showed that in 81% of the poultry farms, the working staff is in contact with other farms, against 19% of farms observing this measure. This contact is frequent by proximity of the farms. The difference between these two categories is very significant($\chi^2 = 16.10$; $p = 0.0001$; $p < 0.05$).

In poultry farms surveyed, poultry is not in direct contact with foreign animals 83,33%. The observance of this biosecurity measure is considered good. The difference between these two categories is very significant ($\chi^2 = 18.67$; $p = 0.0001$; $p < 0.05$).

3.5. Observance of biosecurity measures related to sanitation

Sanitation is one of the biosecurity principles to protect livestock buildings from microbial growth and to have a healthy environment.

98 % of poultry farmers clean the premises and apply the crawl space after each band (Figure 5), compared to only 2% of poultry farmers who do not implement this measure. This measure observed by poultry farmers is considered very good. The difference between these two categories is very significant ($\chi^2 = 38.10$; $p = 0.0001$; $p < 0.05$).

The washing of hands and the use of a footbath are not systematic by the poultry farmers surveyed, some of them ignore this measure of hygiene and do not show any effort to change this behavior (52% of poultry farmers). In contrast, 48% of poultry farmers apply this measure. The difference between these two categories is not significant ($\chi^2 = 0.10$; $p = 0.7576$; $p > 0.05$).

The survey reveals that a strong trend in reuse of defective and old equipment by poultry farmers 83%, against 17% of poultry farmers. The difference between these two categories is very significant($\chi^2 = 18.67$; $p = 0.0001$; $p < 0.05$).

Our results indicate that 60% of poultry farmers do not practice pest control (Figure 6), only 40% of poultry farmers observe this measure. Its observanceis slightly weak. The difference between these two categories is very significant ($\chi^2 = 11.52$; $p = 0.0007$; $p < 0.05$).

The survey indicates that 98% of farms do not practice vaccination to protect poultry against diseases. The difference between these two categories is very significant ($\chi^2 = 38.10$; $p = 0.0001$; $p < 0.05$).

3.6 Biosecurity rate of poultry farms in peri-urban areas of Brazzaville

The assessment of biosecurity in poultry farms in peri-urban areas of Brazzaville made it possible to note the existence of biosecurity rates ranging between 25% and 68%. The average biosecurity rate observed in poultry farms is 44%.

Chart 2 shows that 35.71% of poultry farms have a biosecurity rate of between 25 and 37% ; 45.24% of poultry farms have a biosecurity rate between 40 and 50% and 19.05% of poultry farms have a biosecurity rate between 51 and 70%.

IV. Discussion

4.1Observance of biosecurity measures related to remoteness

The most commonly used measure of removing farm disease is the burial of cadavers (98%), compared to 2% of poultry farms that incinerate. The abandonment of corpses in the open air, not far from livestock buildings is not conducive to observance of biosafety measures.

Attachment to technique by livestock farmers can be explained by cheaper costs.

In fact, incineration requires the construction of an incinerator and the supply of sanitizers, while landfilling is a simple and less expensive technique. KABORET, (2007) encourages this technique which reduces operating costs and saves time. On the other hand (NELSON and TABLANTE, 2004) believe that this causes nuisance, odors and aesthetic problems, not to mention the contamination of surface water and groundwater that can be directly polluted by dead birds at the level of 'a farm. CHERRY (2007) prefers incineration justified by the total eradication of pathologies in the vicinity of the farm.

The fencing of the buildings makes it possible to fight against the thefts and the accessibility of the pests. It is part of the confinement criteria. The presence of a fence is a fundamental element for the isolation of a poultry farm vis-à-vis its environment and the farms are protected. Protecting farms against wild birds is an important part of biosecurity. All livestock buildings must be protected against wild birds and other pests from entering.

KABORET, (2007) encourages the inaccessibility of pests in poultry houses by recommending that farmers keep the doors of buildings tightly closed in order to avoid the intrusion of vectors and pathogens with the ability to cause human diseases aswell as in poultry.

Our results show that food sources are not under control in the majority of farms in peri-urban areas; this is due to the very small number of livestock feed production units in the capital.

The public authorities are totally absent on the food production chain in the Congo; which often leads to shortages and poor quality of food. This poor quality indisputably leads to herd performance (AKOUANGO, 2004).

Farmers alone can not live up to the observance of biosecurity measures related to the quality of the food; it is a public health problem.TEGUIA (2014), charges a load of over 60% related to food in poultry farms.

4.2. Observance of biosecurity measures related to flow control

Our study indicates that the observance of the keeping registers is not respected ; 16.67% of poultry farmers observe the keeping of the visitor register, while 83.33% of poultry farmers do not keep a visitor register.FAO, (2008) reports that visits are a source of germs transmission between farms on the one hand and between live poultry markets on the other.

Non- observance of this biosecurity measure may promote transmission of pathogens from one farm to another.

The very high rate of contact of technical staff with other farms is a major risk of contamination and transmission of pathogens. It is well known that man is a potential vector, mechanical, in the transmission of pathogenic germs (FAO, 2008).

BUTCHER and MILLES, (2003) ; NELSON and TABLANTE, (2004) reported that microbes and pathogens can be found and carried by people's hands, in their hair, and on their clothes and shoes. Indeed, according to RACICOT (2011), several experimental studies have demonstrated the potential role of humans, as a mechanical vector in the transmission of pathogenic germs. For example, certain mycoplasmas like Mycoplasma gallisepticum can be transported by humans (BUTCHER and MILES, 2003).

4.3. Observance ofbiosecurity measures related to sanitation

The practice of biosecurity measures on the reuse of cells was noted in 83% of poultry farmers. This poor practice of honeycomb reuse would be a source of contamination especially when not previously disinfected (FAO, 2008).

40% of farms are fighting against rodents. It is done by means of traps and the use of rat poison as indicated by AKOUANGO et al., (2006).

These measures make it possible to reduce the risk of transfer of pathogenic germs from the outside to the production sites; although the majority of poultry farmers do not respect this biosecurity measure (FAO, 2008). Many pathologies in poultry farms are the cause of poor sanitation (BITTY, 2013).

V. Conclusion

The present study on biosecurity in poultry farms in peri-urban areas of Brazzaville made it possible to evaluate the observance of biosecurity measures on these farms. It emerges from this study that: the observance of biosafety measures is globally less observed. The least observed biosafety parameters are : the control of the food, the keeping of the different registers (registers of the veterinary examinations, registries of the mortalities, registers of the visitors, ...), contact of the technical staff of a poultry exploitation with others, employment of alveoli of good quality, the fight against the pests, the vaccination.

In conclusion, we address our recommendations to breeders and public authorities:

To breeders: (1) poultry farmers must respect the minimum of biosecurity measures; (2) observe the keeping of the various registers mentioned above in order to monitor the health of the livestock; (3) restrict visitor access; (4) use cells of good quality to avoid disease contamination of livestock; (5) fight against pests because they can transmit various diseases; (6) develop and implement the vaccination program against major avian diseases.

To Congolese State : (1) it must identify the food manufacturing units; (2) control the quality of the food produced by these food manufacturing units; (3) subsidize poultry farmers because they can not observe certain biosecurity measures for lack of financial means, namely incineration, vaccination, ... ; (4) Finally, the Congolese State must provide financial assistance to poultry farms for the purchase of veterinary products and food which are very expensive.

All these recommendations once implemented can improve the productivity of poultry farms in peri-urban areas of Brazzaville.

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Figure 1a : Breeding of layers in battery

Figure 1b : Breeding of layers (A) and broilers (B)

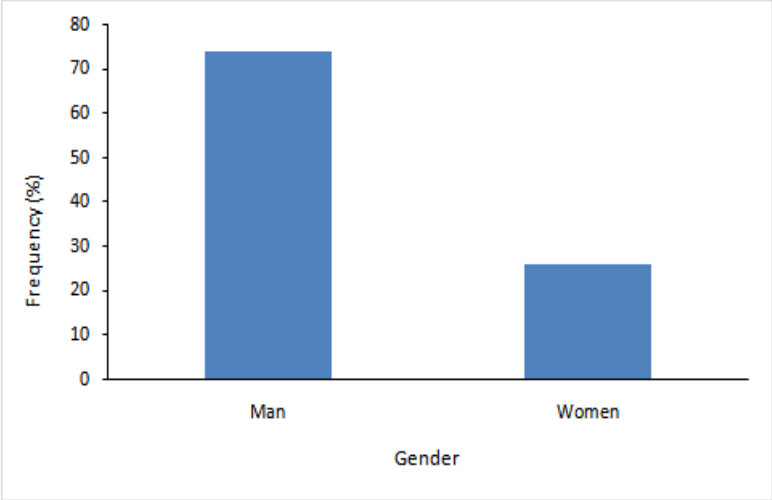

Figure 2 : Distribution of poultry farmers by gender

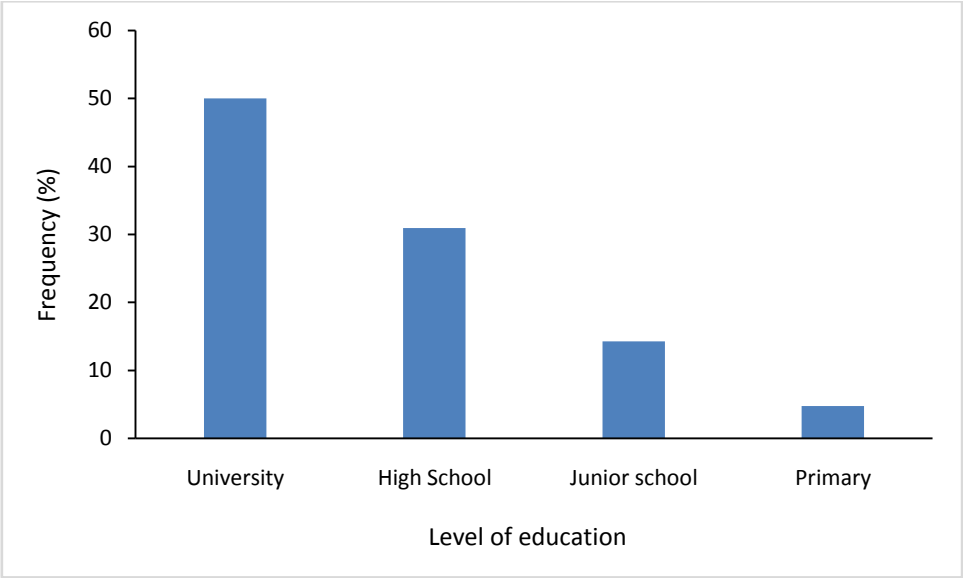

Figure 3 : Level of education of poultry farmers

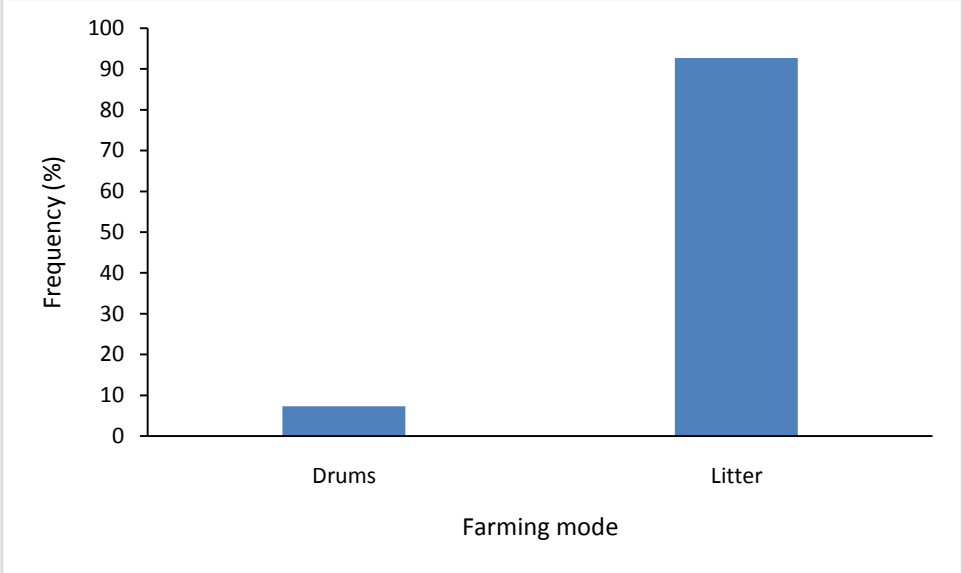

Figure 4 : Percentage of Bedded and Battery Clustered Livestock Systems

Figure 5 : Cleaning and disinfection of premises after the end of the production cycle

Figure 6 : Presence of pests (wild birds) in feed storehouse.

Chart1 : Biosafety rate references according to RACICOT and VAILLANCOURT, (2009)

Biosecurity rate (%)
0-25 : No observance
26-74 :Intermediate observance
> 75 : Good observance

Chart 2 : Farm Biosecurity Rates in peri-urban Areas Brazzaville

Biosecurity rate obtained (%)	Number of farms surveyed	Frequency (%)
25-37	15	35.71
40-50	19	45.24
51-70	8	19.05
Total	42	100

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