Duijvesteijn, N., Vereijken, A., Atikpakpe, R., Toussaint, E., Trabarel, L-P., Perrault, L. (2026) Ten years of local sire line selection and five years of recurrent testing in Burkina Faso: a sustainable model for poultry breeding and knowledge transfer, *Proceedings 13th World Congress on Genetics Applied to Livestock Production* 23463: https://doi.org/10.31274/wcgalp.23463
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Ten years of local sire line selection and five years of recurrent testing in Burkina Faso: a sustainable model for poultry breeding and knowledge transfer

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Introduction

Poultry provides rural families with a low cost, highly efficient and nutritious protein. Providing access to improved chicken breeds suitable for African conditions is key to increase the rural poultry productivity at small-scale farmer level. To supply this rural market, often confronted with challenging conditions, one would need to guarantee the right poultry genetics. Breeding poultry for challenging environments can be approached in multiple ways. Two key strategies are local selection, where breeding decisions are made based on performance under local conditions, and recurrent selection programs, which use systematic testing to inform improvements in a bio secure breeding nucleus, mostly located in Europe or North America. In Burkina Faso, both approaches are uniquely combined at a single facility, enabling a direct comparison and synergy between local adaptation and global breeding. The objective of this study is to present the outcomes of these complementary strategies and to illustrate how their integration strengthens genetic improvement programs.

Materials & Methods

Breeding local sire line 'Coq de Faso'. The Poulet du Faso initiative in Burkina Faso was designed to improve traditional poultry productivity through a combination of local genetic selection and crossbreeding, supported by rigorous health management and biosecurity protocols. The core of the program is the Avian Selection Centre in Boussé. Initial founder populations (sourced in local villages in 2016) comprised approximately 130 males and 400 females, quarantined and screened for major diseases (leucosis, mycoplasma, salmonella). Pedigree management is maintained by housing birds in 40 family pens (one male, 10–13 females), with trap nest boxes enabling individual egg and parentage recording. Selection is based on both individual and family performance, with special attention to minimizing inbreeding. Growth, mortality, and reproductive traits are systematically recorded. For generation 9, about 3,280 chickens were produced. At 72 days, all chickens were weighed and scored for feather and shank color, and body size. Selection of breeding candidates was performed using BLUP breeding values.

Recurrent testing in Burkina Faso. Since 2020, the SAPPSA (Securing Affordable Poultry Parent Stock for Africa) project, supported by the Gates Foundation, has introduced a new collaborative approach: recurrent testing of SASSO lines (part of Hendrix Genetics, referring to dual-purpose chicken lines) at the Avian Selection Centre in Boussé.
In this conference paper we present the results of a female line, part of the commercial parent stock female SA51A. The recurrent test data consist of a pedigreed father and unknown mother (producing a crossbred offspring SA51A). Table 1 shows the number of observations in the

different tests both collected in France and Burkina Faso to establish the recurrent test traits. The number of offspring per father varied between 30 and 53. Pureline data is not shown, but >10 generations are recorded at the nucleus facility of SASSO, Sabres, France.

Table 1. Overview of data used for prediction of recurrent test EBVs for female line.

Generation	Hatch Date	N females tested	N sires used	Location
LAY001	14/01/2020	4016	78	Burkina Faso
LAY002	18/08/2020	3976	75	France
LAY003	12/02/2021	3562	75	Burkina Faso
LAY004	25/08/2021	3450	74	France
LAY005	28/01/2022	3511	82	Burkina Faso
LAY006	17/08/2022	3829	76	France
LAY007	15/02/2023	3619	74	Burkina Faso
LAY008	23/02/2024	3566	90	Burkina Faso
LAY009	03/04/2024	2229	75	France
LAY010	23/04/2025	1169	35	France
LAY011	29/01/2025	3600	90	Burkina Faso

Fixed effects fitted were sex and hatch week. Linear mixed models were used to estimate the variance components and the data was fitted in the program DMU (Madson and Jensen, 2008) using multi-variate analyses. Traits were defined by being measured either in pureline or crossbred animals. The resulting genetic correlations reflect a combination of pureline-crossbred performance effect and/or genotype-by-environment effect since pureline animals where always housed in the nucleus facility in France, and recurrent test animals where both tested in France and Burkina Faso. Covariances between residual effects in the pureline and crossbred dataset were set to zero, as animals did not have observations in different environments.

Results & Discussion

Phenotypic and genetic progress Coq du Faso. Over nine generations of selection at the Boussé Avian Selection Centre, substantial genetic improvement was achieved in both reproductive and growth traits Fig. 1. The average laying rate of local hens nearly doubled in the first 4 generations. The total hen-day production, increased from 39 eggs at 55 weeks in the first generation to 79 eggs in the fourth generation and to 107 in the seventh generation.
Selection for growth resulted in a consistent increase in body weight, with each new generation gaining an additional 40–55 grams by 10 weeks of age, corresponding to an average annual improvement of 5%. Genetic trends, as estimated by BLUP breeding values, showed positive selection differentials for egg production, egg weight, hatchability, broodiness and body weight, with realized genetic gains in the desired direction for all key traits. Heritability estimates were high for most traits except hatchability and broodiness, which were moderate. Notably, egg production was strongly negatively correlated with broodiness, while egg weight was positively correlated with body weight and size.

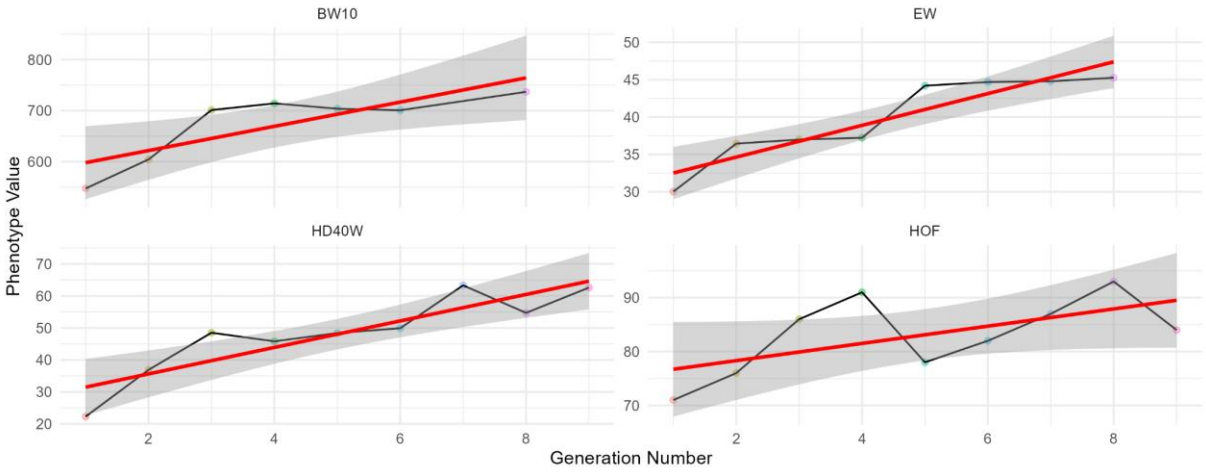

Figure 1. Overview of the phenotypic trend of 4 traits from the Coq du Faso breeding program. BW10 = body weight at 10 weeks; EW = Egg weight; HD40W = Hen day production 40 weeks of age; HOF = Hatch of fertile.

Inbreeding Levels. Inbreeding increased moderately to 6.5% by generation 9, with annual increments of ~1%. Optimized mating strategies are expected to limit generation 10 inbreeding to ~7.3%, about 1% lower than under random mating.

Genetic progress recurrent test SASSO line. Pureline egg production traits showed moderate heritabilities (0.24–0.23), while recurrent test traits had lower heritabilities (0.09–0.06), reflecting environmental stress and data variability. Genetic correlations among EP1 and EP2 were positive across environments (Table 2). Over recent generations, selection emphasis on recurrent test traits resulted in stronger gains under recurrent test conditions compared to pureline responses. For example, RT_EP1 increased from 2.2 to 7.7 eggs, compared with PL_ EP1 improvement from 4.7 to 8.1 eggs as shown in Fig. 2.

Table 2. Heritabilities and genetic correlations between pureline and recurrent test EP traits.

	PL_EP1	PL_EP2	RT_EP1	RT_EP2
PL_EP1	0.24 ±0.01	0.61±0.08	0.25±0.19	0.22 ±0.2
PL_EP2		0.23 ±0.04	0.54 ±0.18	0.55 ±0.19
RT_EP1			0.09 ±0.03	0.76±0.1
RT_EP2				0.06 ±0.02

Complementing strategies to maximize progress and impact. Simple calculations can show how improving a local sire line such as the Coq de Faso combined with a global breeding program including recurrent test traits (aiming to improve performance under challenging conditions) can both benefit the local breeding program, global breeding program, local hatchery and the smallholder farmer. These results clearly show that the local breeding program can be ran more efficiently (higher egg production f.e.), while the global breeding program can gain access to new markets and strengthen its product portfolio. The local hatchery improves performance considerably as well. Assuming a market to serve with 6.66 million day old chicks (DOC) coming from 50K parent stock flock in 2020 (15% mortality) with an average egg production of 180 eggs and HOF of 80%. In 2025 with the same output (6.66 million DOC) the hatchery only needs to buy 43K parent stock (10% mortality) and 14% fewer males and improved HOF to 88%, assuming the genetic progress as presented in this section. This results in an increased efficiency of 14% overall in 5 years time. Not only does this strengthen the

position of the hatchery, additionally the carbon footprint has improved considerable. The smallholder farmer is also benefiting with improved growth (~23 grams on average between progress in Coq de Faso and SA51A per generation) and when used as dual purpose bird an improvement of 2 eggs each generation. This collaboration is a unique example how local and global breeding can strengthen the poultry value chain in rural areas both in terms of financial performance, improved footprint and local development.

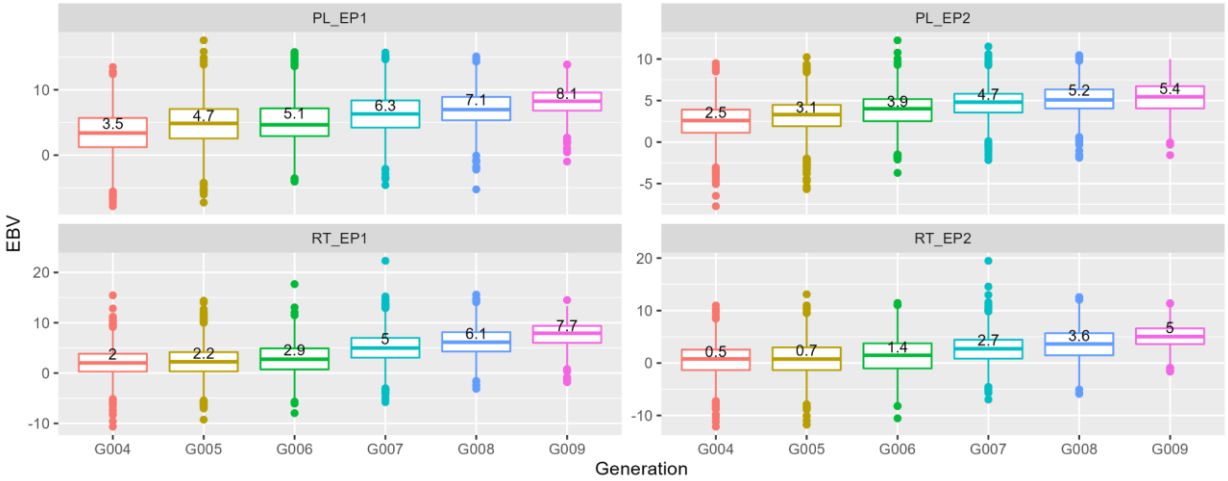

Figure 2. Overview of the genetic trend for the four mentioned traits across the last 6 generations. Selection on recurrent test egg production started from generation G005.

Conclusions

This study demonstrates how combining a locally selected sire line with recurrent testing of globally bred lines provides a sustainable and effective approach to improving poultry performance under challenging African smallholder conditions. Ten years of selection in the Coq de Faso line have resulted in substantial gains in egg production, growth, and overall efficiency, while maintaining genetic diversity at acceptable levels. The recurrent testing of SASSO lines further complements local progress by identifying genotypes that perform well under challenging conditions. Together, these strategies enhance breeding program resilience, strengthen hatchery efficiency, and deliver tangible benefits to small scale farmers with more eggs, higher body weights of the chickens and therefore more income and / or more protein to consume by their families. The integration of local adaptation and global breeding innovations represents a practical and scalable model for genetic improvement and rural development across environments.

Acknowledgements

This conference proceeding is based on research funded by the Gates Foundation.

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