Individual variability of range use and genetic strategies

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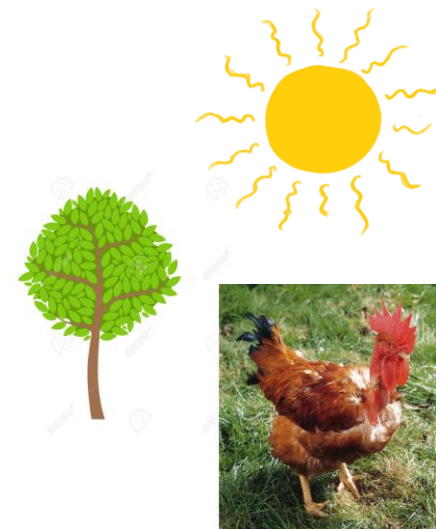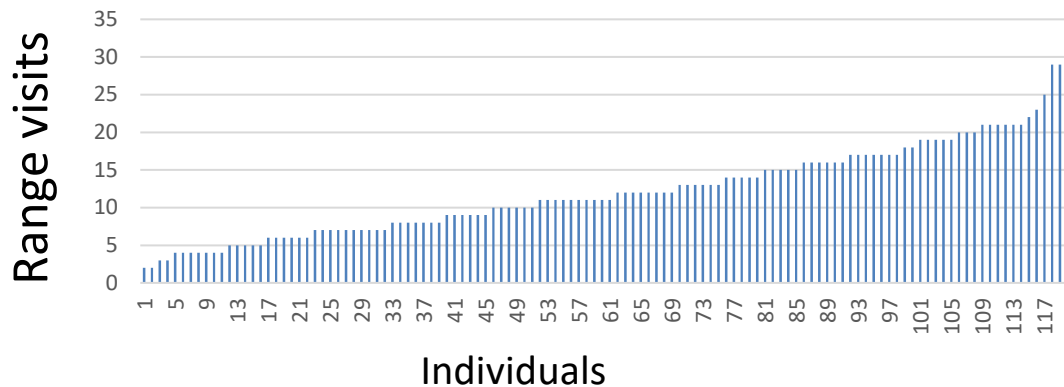
PPILOW Final conference – Africa Museum, Tervuren (Brussels)
11th-12th June 2024

In the best conditions…. there is great variability in the range use

Personality?

⬇

YES!

Range visits / Individuals

Foraging and range visits, both exploratory behaviors, are stable over time and in different situations

Spearman Correlations		
BEFORE range access (P1) – EARLY range access (P2)	EARLY range access (P2) – LATE range access (P3)	BEFORE range access (P2) – LATE range access (P3)
Foraging 0.233*	0.194*	0.340***

Ferreira et al., 2022. Foraging Behavior Shows Individual-Consistency Over Time, and Predicts Range Use in Slow-Growing Free-Range Male Broiler Chickens. Frontiers in Veterinary Science, 9

Frontiers
https://www.frontiersin.org

Range visits (Early RA + Late RA)

| Foraging		Range visits (Early RA + Late RA)
Spring	Before RA	0.29(*)
	Early RA	0.34**
	Late RA	0.45***
Fall	Before RA	0.33 *
	Early RA	0.53***
	Late RA	0.32*

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- Individual propensity to explore (more or less) has to be taken into account to evaluate the impact of the access to the range:

➢ **Variability of range use between individuals, in different genetic lines, and trade-offs with performance, health and welfare related traits in organic broilers (PART1)**

- Individual consistency over time of exploratory behaviors suggests a possible genetic determinism:

➢ **High-throughput phenotyping to characterize range use and initiate genetic studies (PART2)**

Bonnefous et al., 2023. Behavioural indicators of range use in four broiler strains
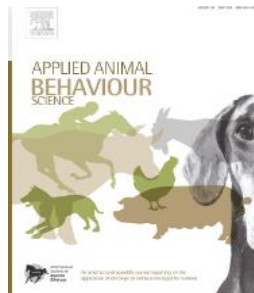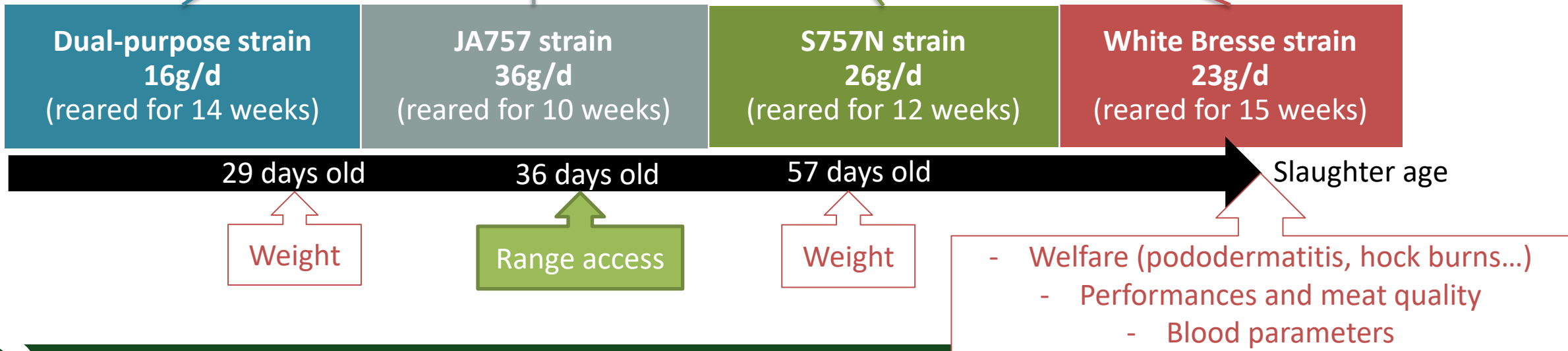

Collet et al., 2024. High-throughput phenotyping to characterise range use behaviour in broiler chickens.
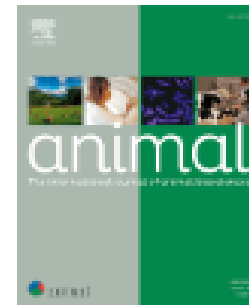
Bonnefous et al., Performance, meat quality and blood parameters in four strains of organic broilers differ accord...
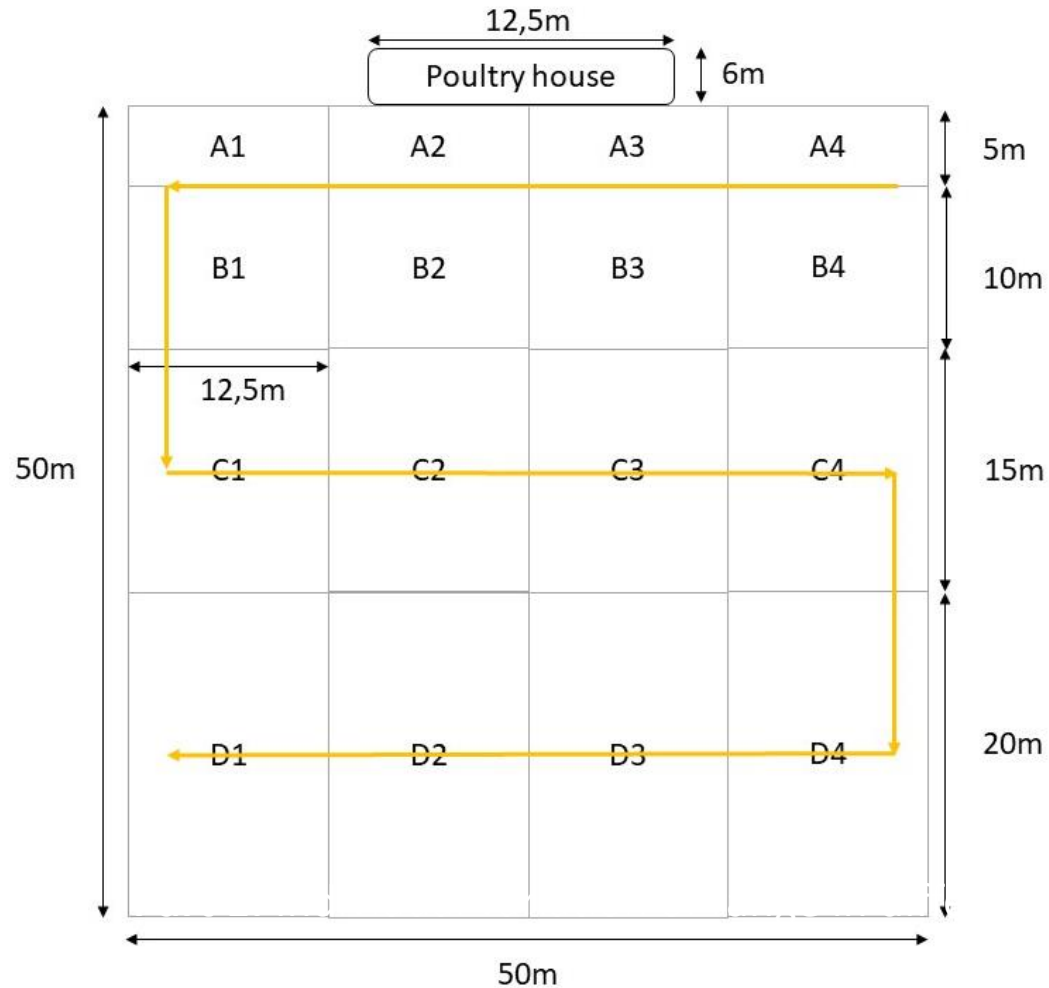
scientific reports

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4 strains: 1 per range; 750 animals per strain ; 50% male, 50% female

Dual-purpose strain 16g/d (reared for 14 weeks)	**JA757 strain 36g/d** (reared for 10 weeks)	**S757N strain 26g/d** (reared for 12 weeks)	**White Bresse strain 23g/d** (reared for 15 weeks)

29 days old   36 days old   57 days old   Slaughter age

Weight

Range access

Weight

- Welfare (pododermatitis, hock burns…)
- Performances and meat quality
- Blood parameters

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FIGURE OF SCAN SAMPLING : ⟵ Observer's path

7 times per day of **Scan Sampling**
from sunrise to sundown

11 to 15 days of scan sampling
depending on the rearing length

Distance Index =
number of times recorded in zone A *2.5 +
number of times recorded in zone B *10 +
number of times recorded in zone C*22.5 +
number of times recorded in zone D*40

Results: Variability of individual range use

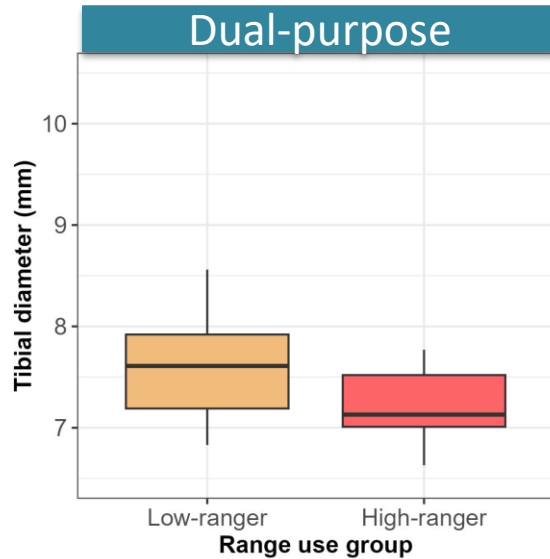**JA757 (36g/d)** | **S757N (26g/d)** | **White Bresse (23g/d)** | **Dual-purpose (16g/d)**
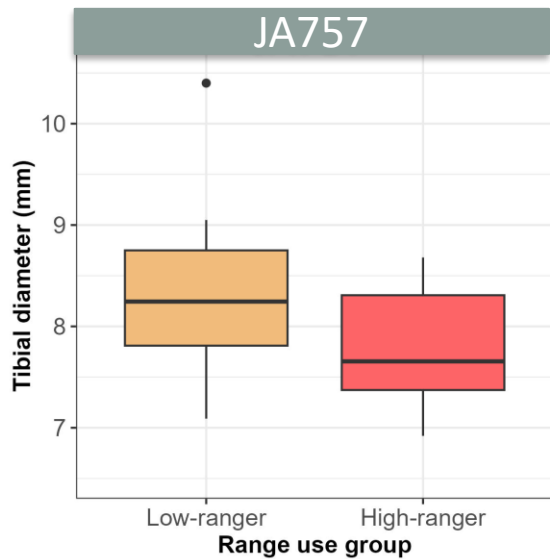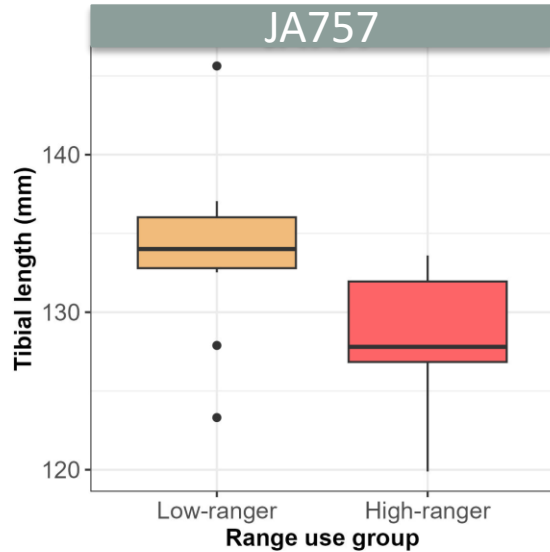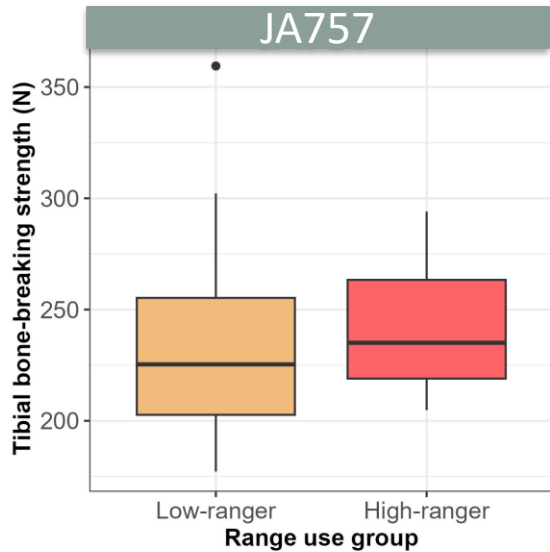
Distance index after 10 days of observation
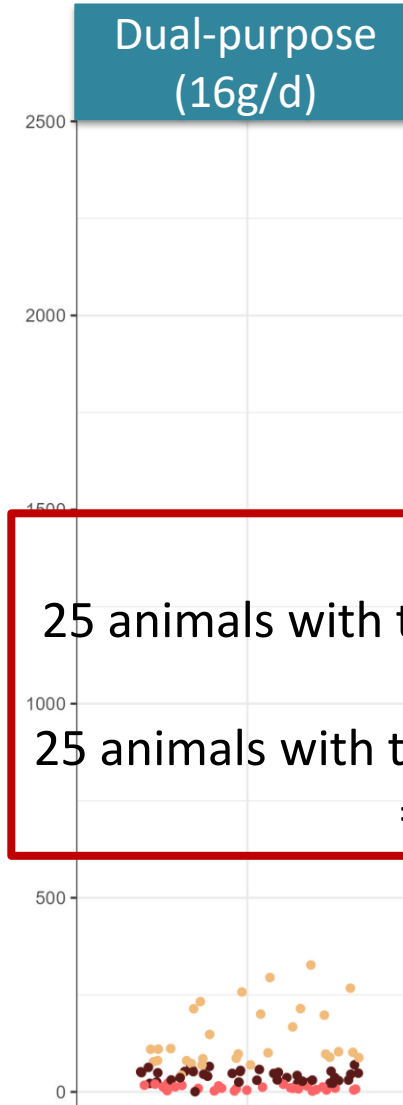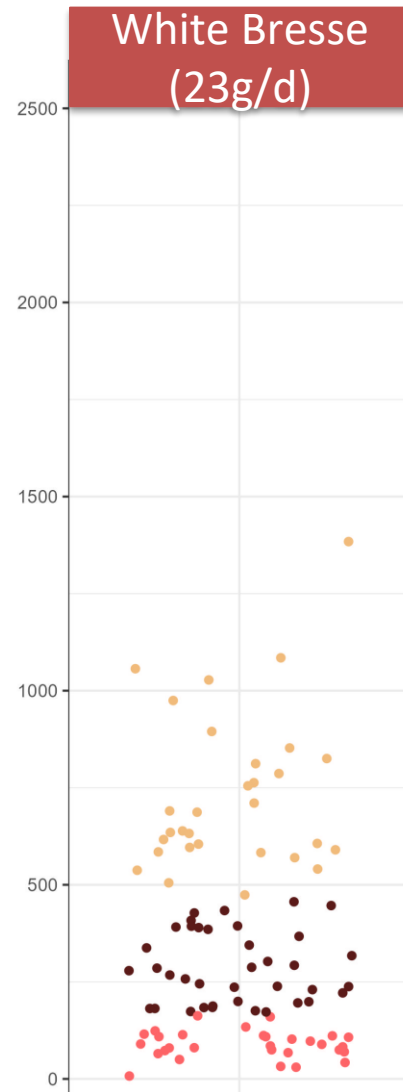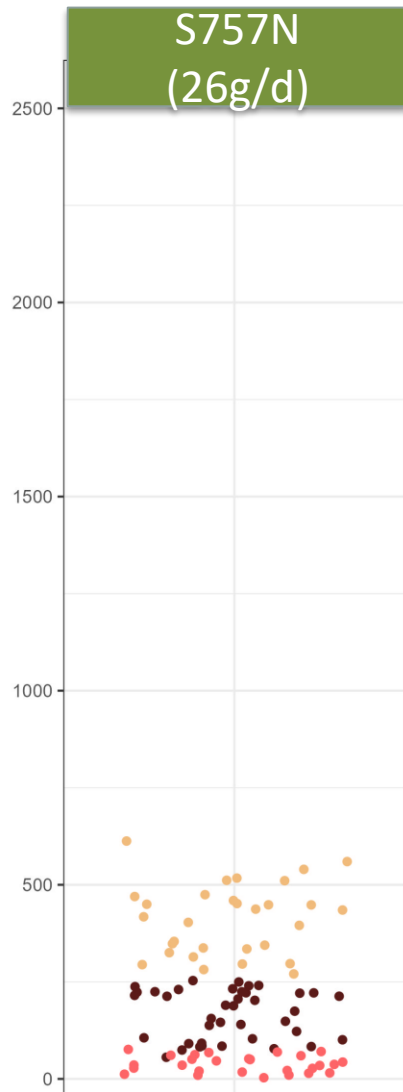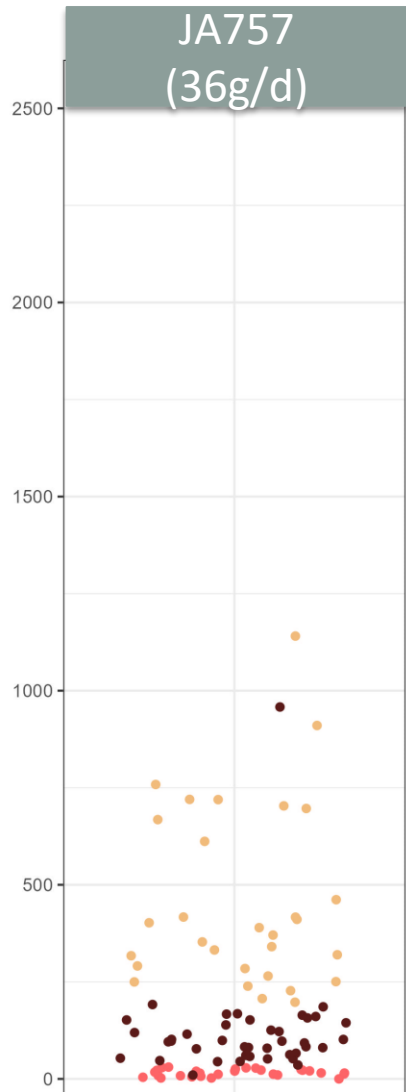
Impact of range use variation within strains?

Selection :

25 animals with the lowest Final Distance Index
= low-rangers
25 animals with the highest Final Distance Index
= high-rangers

Results: Relationship between range use and welfare indicators?

JA757 — Tibial bone-breaking strength (N)

JA757 — Tibial length (mm)

JA757 — Tibial diameter (mm)

Dual-purpose — Tibial diameter (mm)
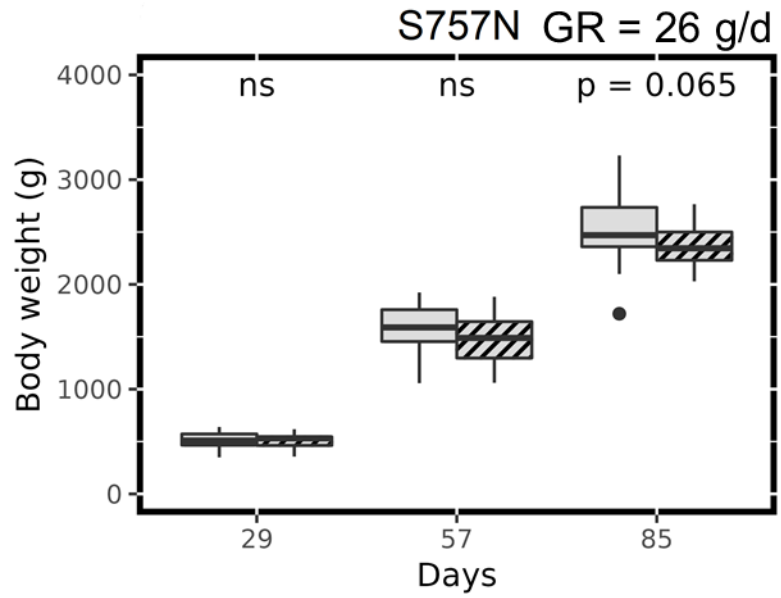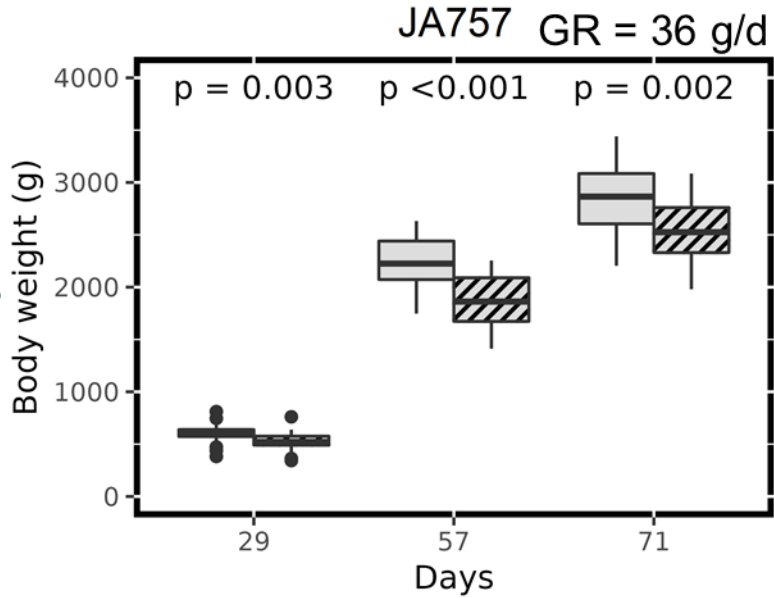
Range use

NO → Pododermatitis
Hock burns
Behaviour at slaughter

YES → **Bone health**
Increased bone strength +
decreased bone diameter and length
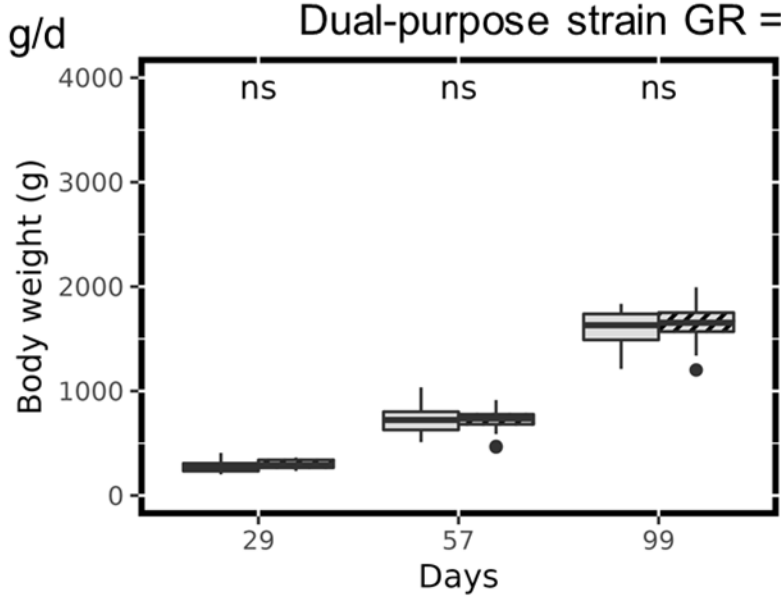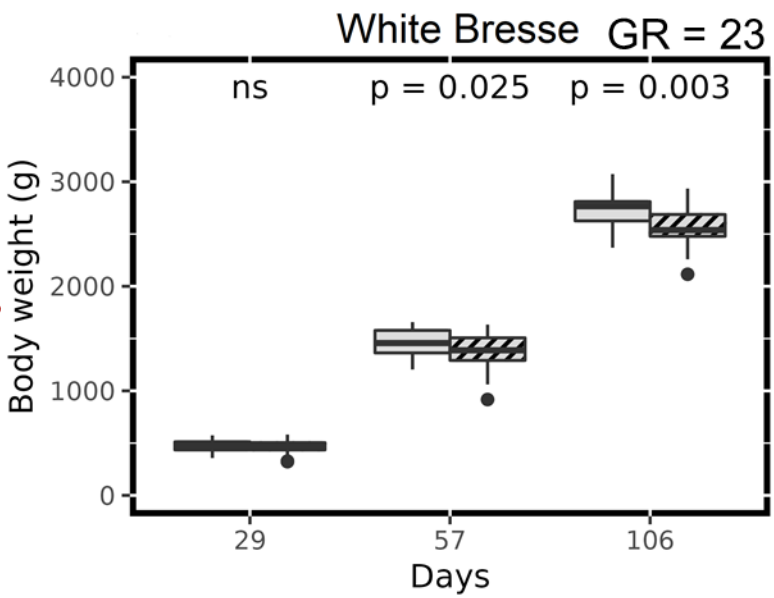**Higher locomotor activity**
of high-rangers

Low-rangers

High-rangers

Lower BW predisposal factor to higher range use? HR birds already more active before range access?

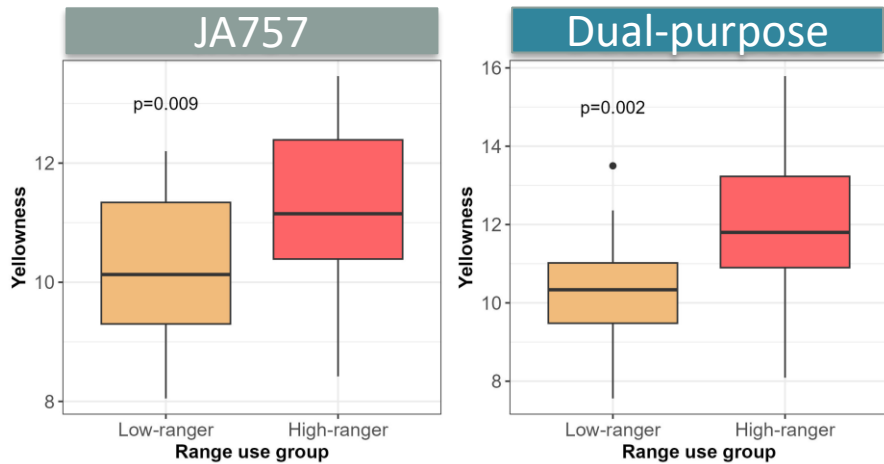Higher range use impairs final BW

Higher range use impairs final BW

No relationship between range use and body weight

In all strains but the dual-purpose, carcass/breast/thigh weights are higher in Low Rangers than in High Rangers
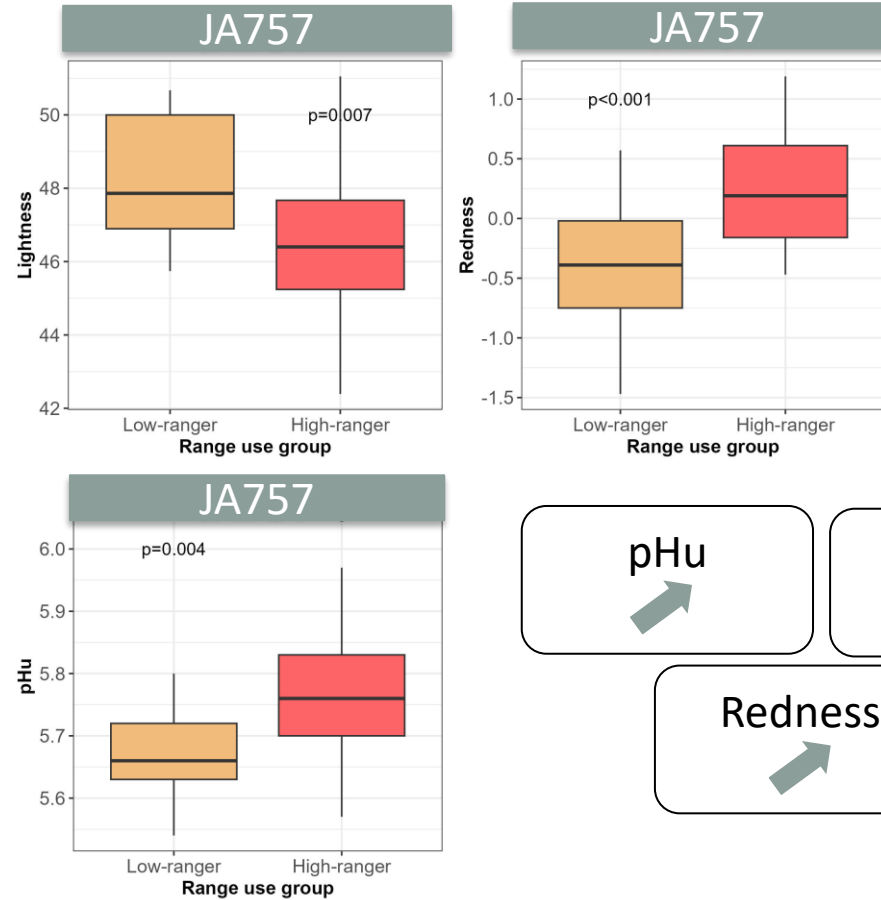
Results: Relationship between range use and bird's physiology?

Muscle development
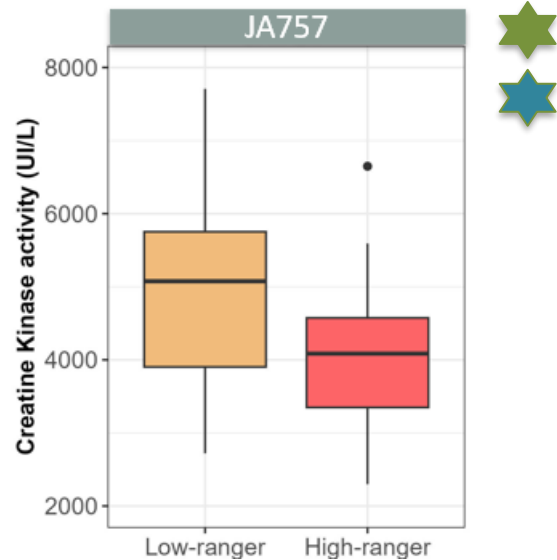
Redox status
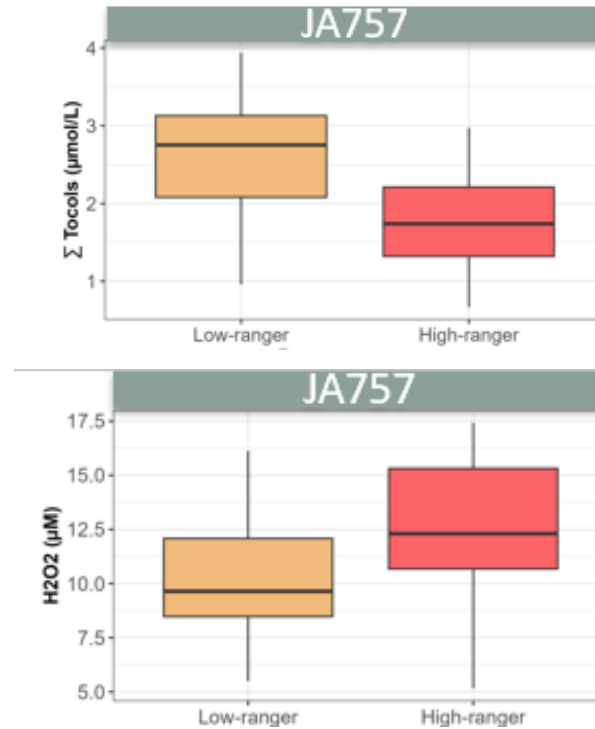
Antimicrobial defense
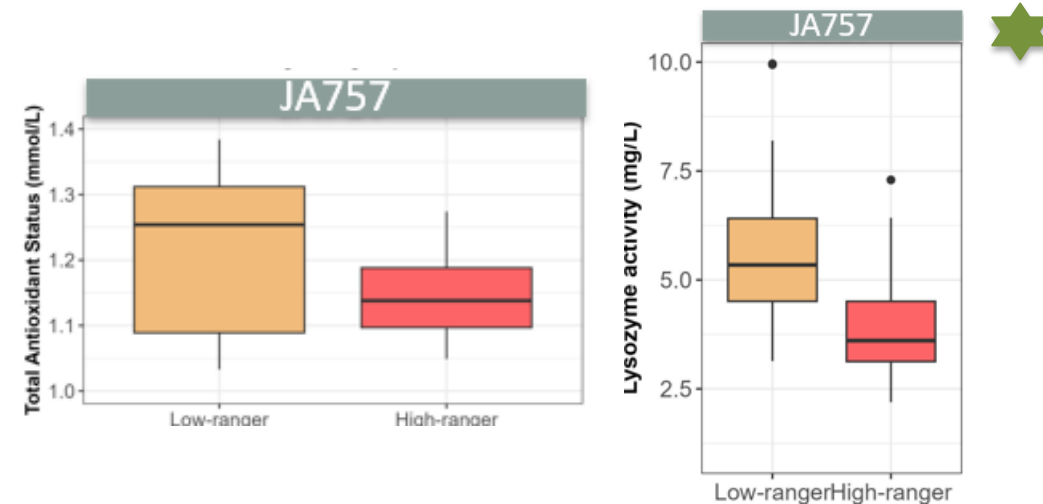
JA757
S757N
White Bresse
Dual-purpose

In medium-growing birds, higher physical activity (in HR group) may limit muscle growth and antimicrobial potential and increase oxidative stress

- Interest of a **multi-trait approach** to evaluate the adaptability of birds to free-range. The balance between positive effects of range use, increasing foraging and physical activity, and the related energetic costs is strain/individual dependent (*the most is maybe not the best!*).

- Range use is **highly variable** among breeds and individuals. Need **tools to monitor range use** at larger scale to decipher the environmental and genetic determinism **of this personality trait**

RFID Chip

100 males + 100 females

Antenna
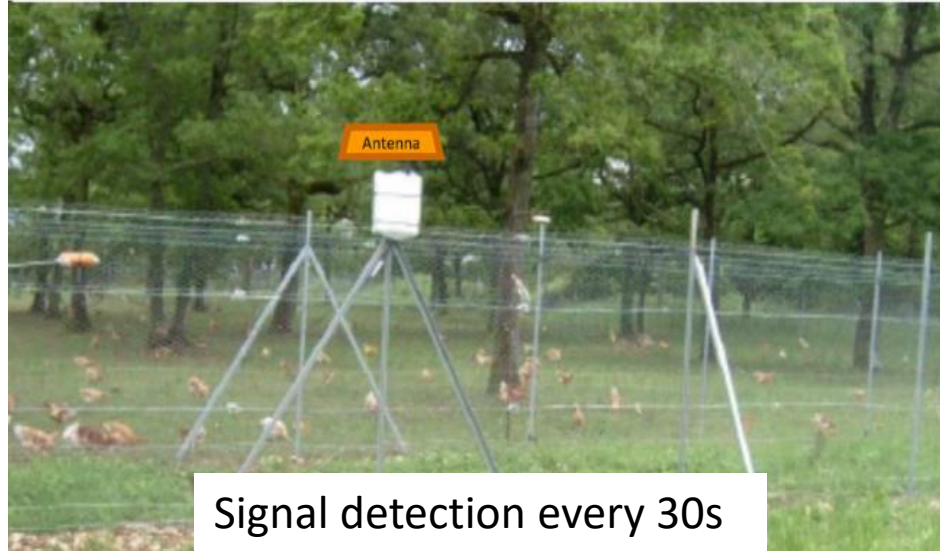
Signal detection every 30s

Z7 ~ 300 m²	Z8 ~ 900 m²	Z9 ~ 300 m²
Z4 ~ 100 m²	Z5 ~ 300 m²	Z6 ~ 100 m²
Z1 ~ 100 m²	Z2 ~ 300 m²	Z3 ~ 100 m²

Barn

for all the strains but the White Bresse, acceptable error rate (2% to 15%) for the 9 zones

Daily measurements of:

Barn time: Time spent in the barn

Outs: Number of times a bird went out

Range: Number of zones explored [0-9]

Gregariousness: Measure that increases with a bird's time spent close to its peers

Zone changes: Number of zone changes (proxy of activity?)

Certified

Different behavioral components of range use
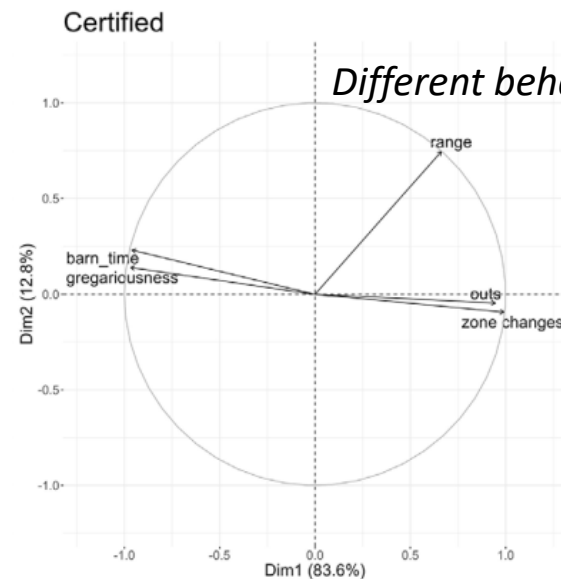
Range use increased with age and outdoor temperature (in spring), did not differ between sexes.

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600 pedigree birds (mixed sex) placed on two ranges (with trees) between April and July 2023

Variables - PCA
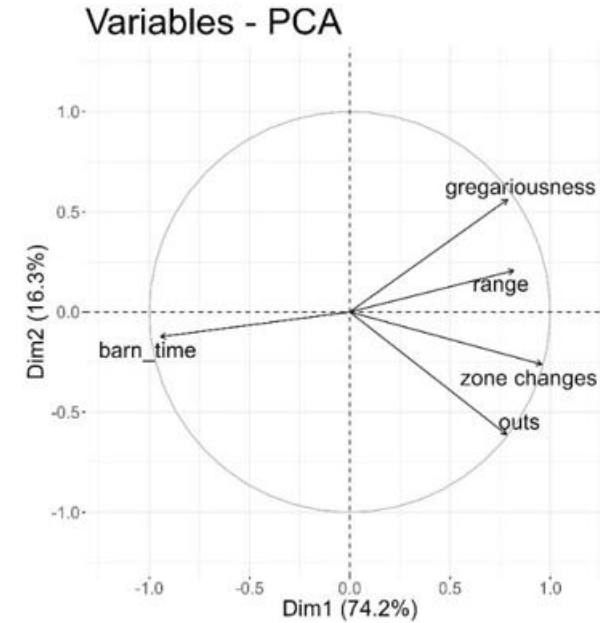
Traits	Mean ± SD	h²
Range use		
Barn_time	0.75 ± 0.11	0.45 ± 0.12
Gregariousness	8.67 ± 5.68	0.38 ± 0.11
Range	8.34 ± 0.88	0.28 ± 0.11
Outs	0.097 ± 0.044	0.50 ± 0.34
Zone changes	0.274 ± 0.12	0.35 ± 0.11

Selecting range use behaviour in a breeding population would be feasible. Genetic correlations with performance and physiological indicators?
➔Potential of selection for the bird's adaptability to the free range

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Thank you for your attention

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