Range use relationship with welfare and performance indicators in four organic broilers strains

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Societal demand: Expression of the natural behaviour of animals

van Asselt et al., 2017

→

Production of free-range and organic broilers

IFOAM, 2018

Issue: lack of range use by some batches of chickens

Range use linearly increases with time per animal but varies within one flock

→ May be qualified as a personality trait

Ferreira et al., 2019; Bonnefous et al., 2023

What are the consequences of range use on animals and production ?

- Health and welfare
- Physiology and metabolism
- Performance and meat quality

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PPILOW Method – Experiment from February until June 2021

4 strains: 1 per range; 750 animals per strain ; 50% males, 50% females

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 — 36 — 57 — 64 — Slaughter — Days of age

- 29: Weight
- 36: Range access
- 57: Weight
- 64: Selection on range use
- Slaughter: Performances and meat quality; Welfare (pododermatitis, hock burns…); Blood parameters

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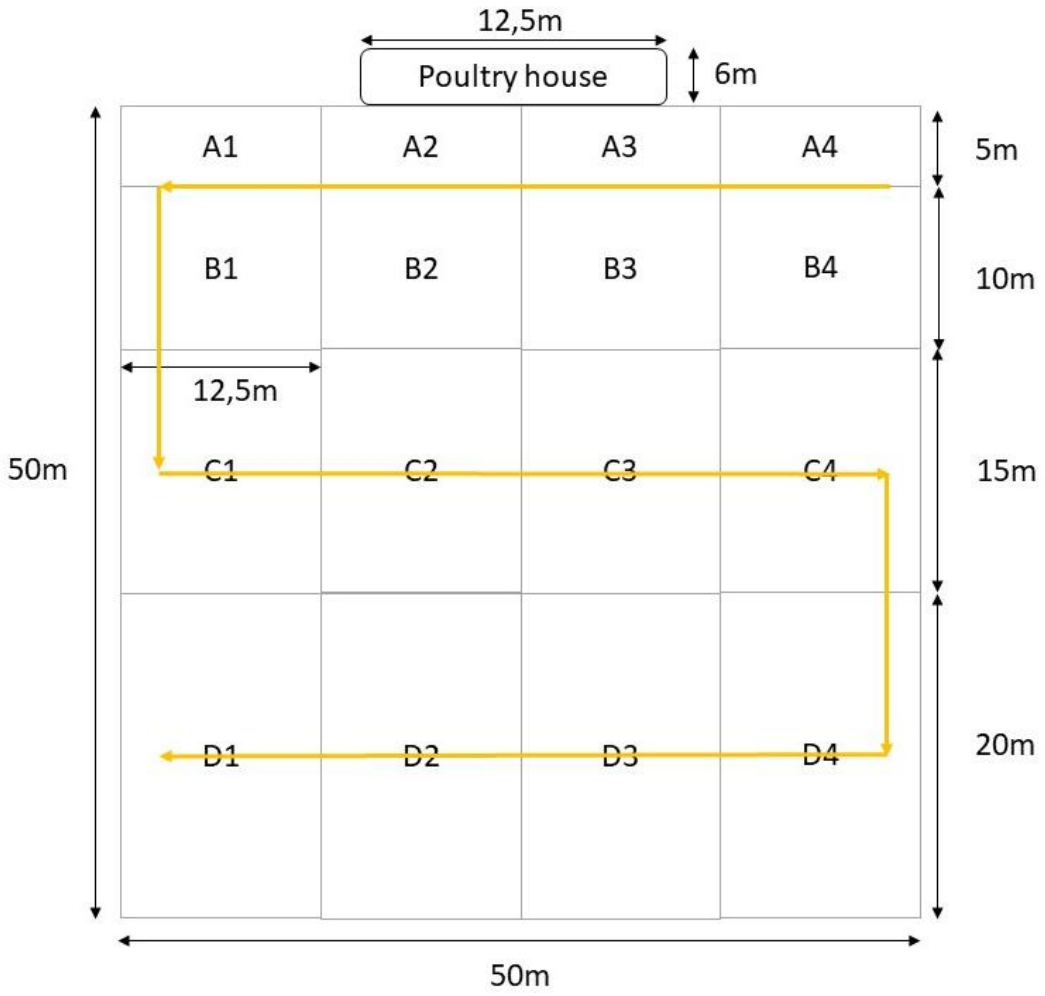
PPILOW Method – Experimentation from February until June 2021

Ferreira et al., 2019

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 duration

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

Selection :
25 animals with the lowest final distance index
= low-rangers
25 animals with the highest final distance index
= high-rangers

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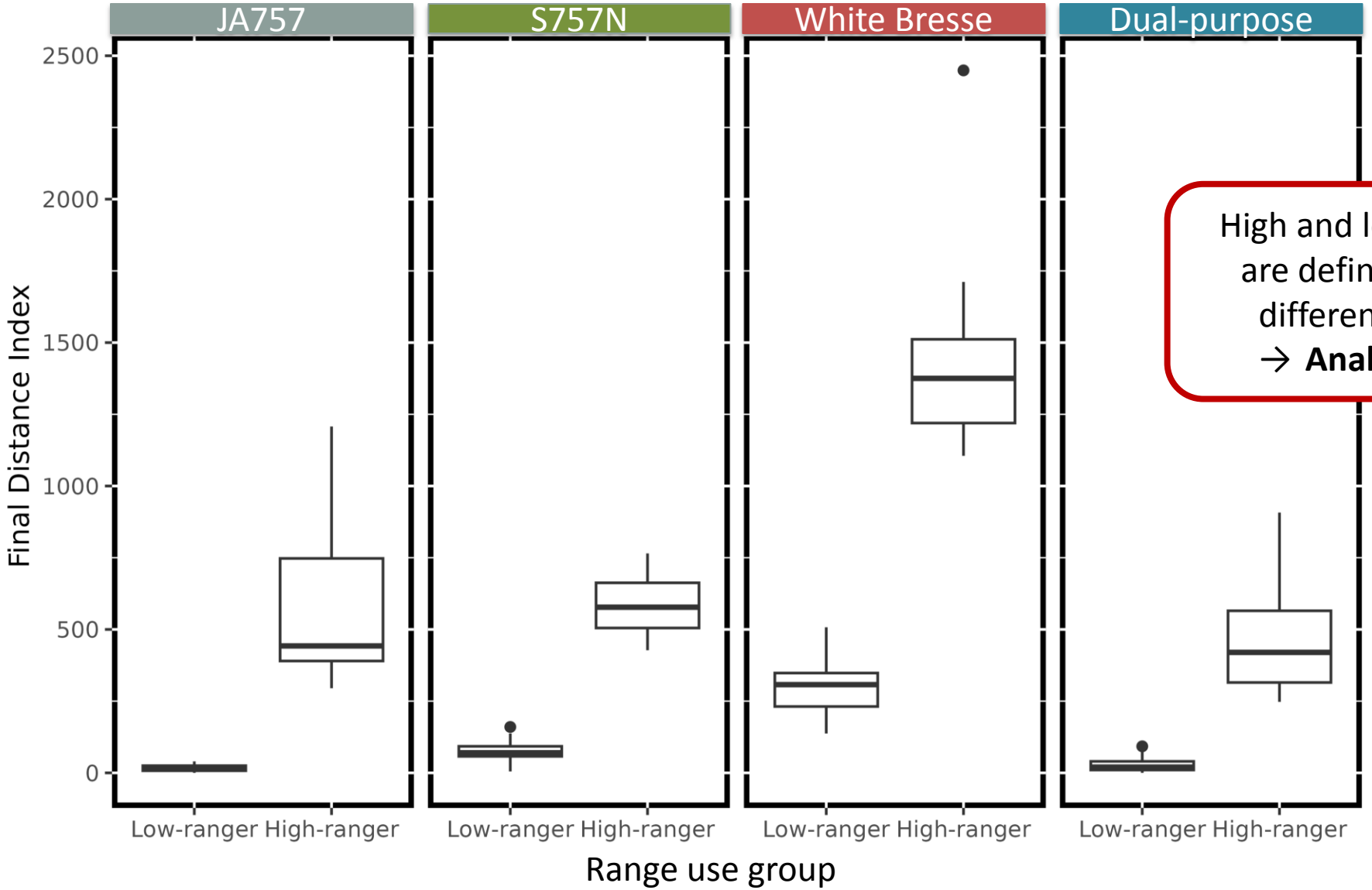

High and low ranger groups are defined per strain on different outdoor runs
→ **Analyses per strain**

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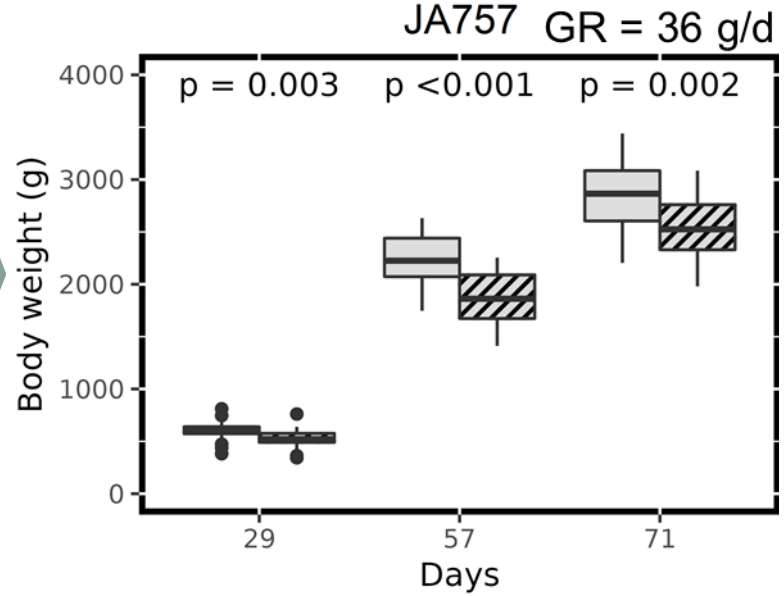
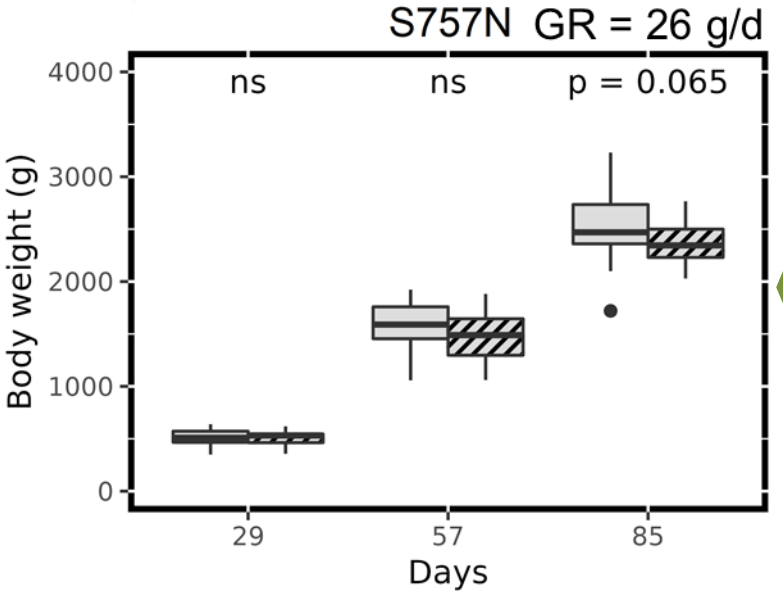
PPILOW Results Performance : growth

Low-rangers
High-rangers

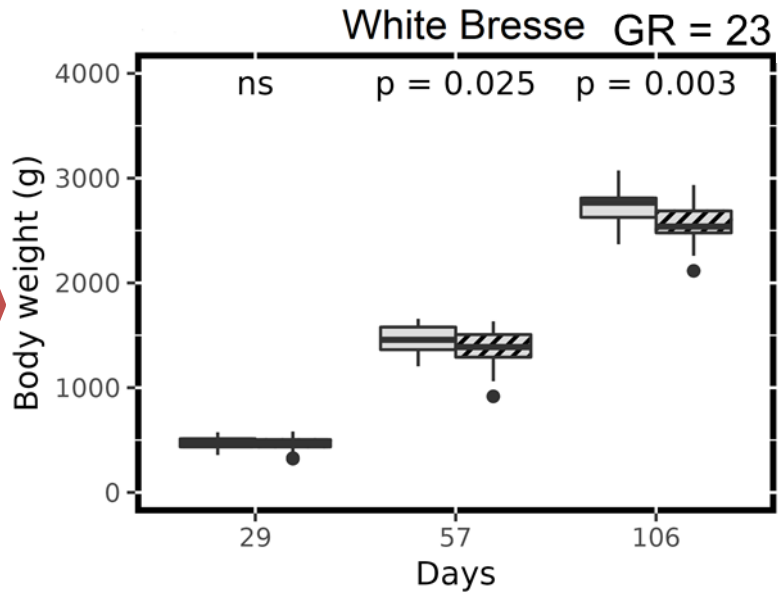
Differential body weight may be partly a cause of differential range use?

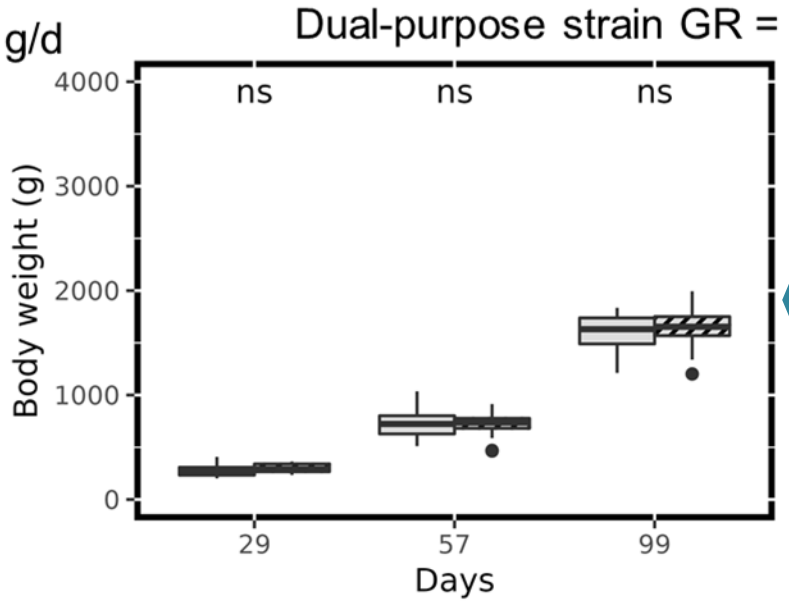




Differential body weight may be a consequence of differential range use?

Differential body weight may be a consequence of differential range use





No relationship between range use and body weight

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PPILOW Results Performance: Meat yields and quality

Item	JA757			S757N			White Bresse			Dual-purpose		
	LR (n=25)	HR (n=25)	P	LR (n=25)	HR (n=25)	P	LR (n=25)	HR (n=25)	P	LR (n=25)	HR (n=25)	P
Growth performances												
Carcass weight (g)	1973 ± 268	1748 ± 227	**0.006**	1740 ± 243	1606 ± 150	**0.047**	1802 ± 131	1672 ± 145	**0.006**	997 ± 120	1026 ± 125	0.605
Carcass yield (% of BW)	69.4 ± 1.3	68.6 ± 1.5	*0.072*	69.0 ± 1.6	67.6 ± 1.3	**0.006**	65.7 ± 1.4	65.1 ± 1.4	0.176	63.2 ± 1.3	62.3 ± 1.1	**0.009**
Breast weight (g)	233 ± 37	201 ± 31	**0.006**	183 ± 30	168 ± 18	**0.047**	176 ± 15	165 ± 19	*0.068*	83 ± 13	84 ± 12	0.702
Breast yield (% of BW)	16.4 ± 1.1	15.8 ± 1.0	*0.072*	14.5 ± 1.1	14.1 ± 1.0	0.236	12.8 ± 0.7	12.8 ± 0.8	0.994	10.5 ± 0.9	10.3 ± 0.6	0.605
Thigh weight (g)	351 ± 48	315 ± 37	**0.012**	322 ± 39	300 ± 33	**0.047**	358 ± 27	332 ± 27	**0.006**	195 ± 23	199 ± 24	0.653
Thigh yield (% of BW)	24.7 ± 0.9	24.8 ± 0.5	0.518	26.0 ± 1.3	25.2 ± 1.0	**0.047**	26.2 ± 0.9	25.9 ± 0.8	0.316	24.8 ± 0.5	24.2 ± 0.6	**0.018**
Meat quality												
Yellowness (b*)	10.2 ± 1.2	11.3 ± 1.4	**0.009**	11.1 ± 1.4	11.1 ± 1.7	0.973	11.9 ± 1.3	11.8 ± 1.0	0.903	10.2 ± 1.4	12.0 ± 1.7	**0.002**

In overall, higher cut meat weights and yields in Low Rangers than in High Rangers

→ Trade-off between range use and performances

Higher foraging activity → higher consumption of grass containing carotenoids → higher intake of carotenoids (Mattioli et al., 2022)

PPILOW Results Physiology and metabolism : blood parameters at slaughter

- JA757
- S757N
- White Bresse
- Dual-purpose

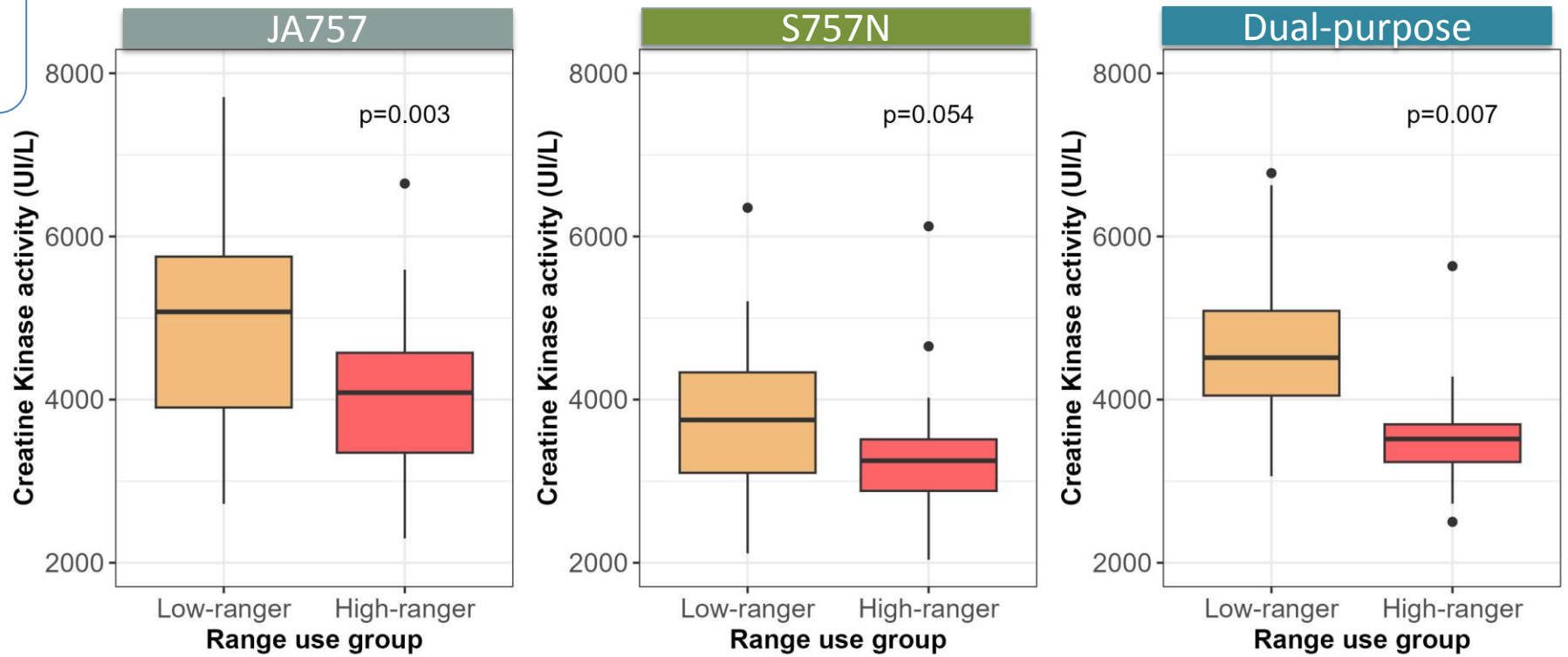
Range use

Retained Energy?

Muscle growth

Creatine kinase activity

Less cellular stress?



Creatine kinase activity is associated with muscle growth rate (Berri et al., 2007)

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PPILOW **Results** Physiology and metabolism : blood parameters at slaughter

- JA757
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Range use

Locomotor activity?

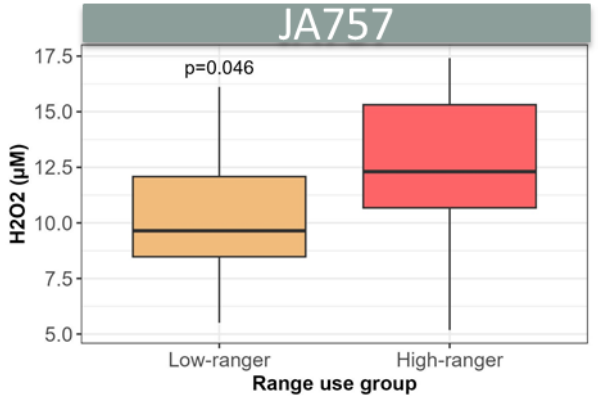
Redox status

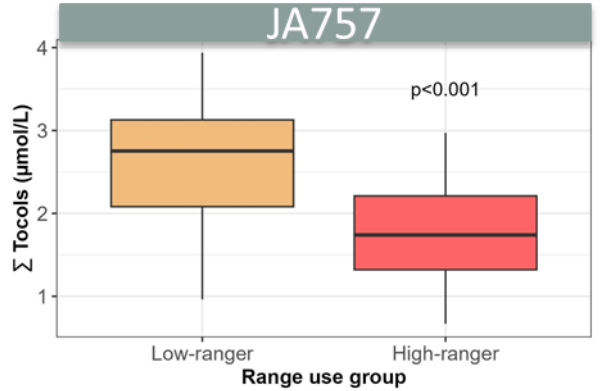
Oxidants : $[H_2O_2]$

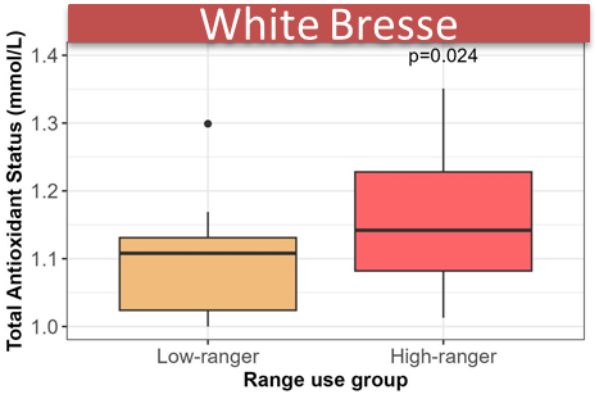
Antioxidants :

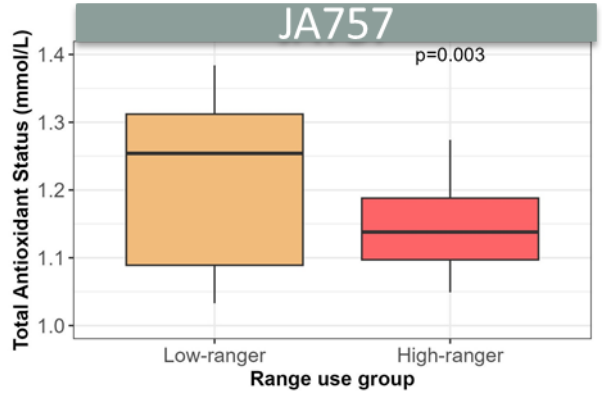
∑ [Tocols]

Total Antioxidant Status









Antioxidants (TAS, vitamin E) decrease and oxidation indicator (H2O2) increases with locomotor activity (Mattioli et al., 2017)

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PPILOW Results Physiology and metabolism : blood parameters at slaughter

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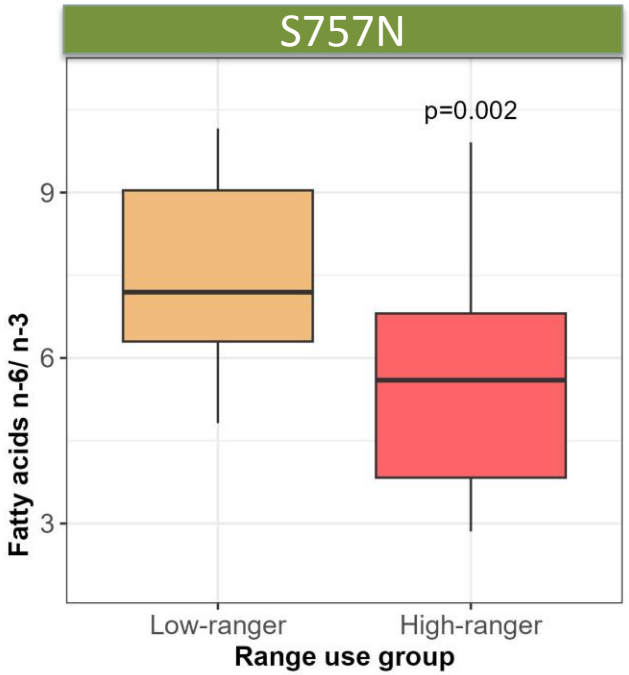
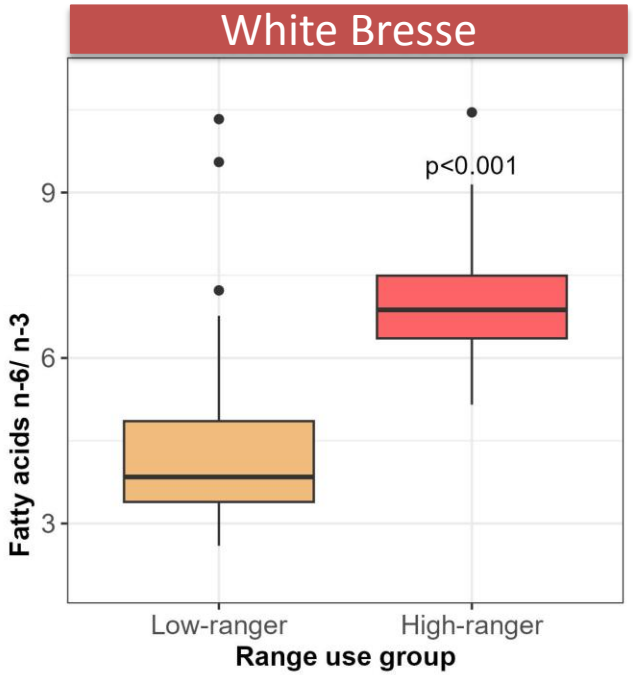
Range use

Potential foraging activity?

n-6/n-3 fatty acids





Foraging activity → consumption of grass with low n-6/n-3 fatty acids → low n-6/n-3 in the blood (Mattioli et al., 2022)

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PPILOW Results Health and Welfare

- JA757
- S757N
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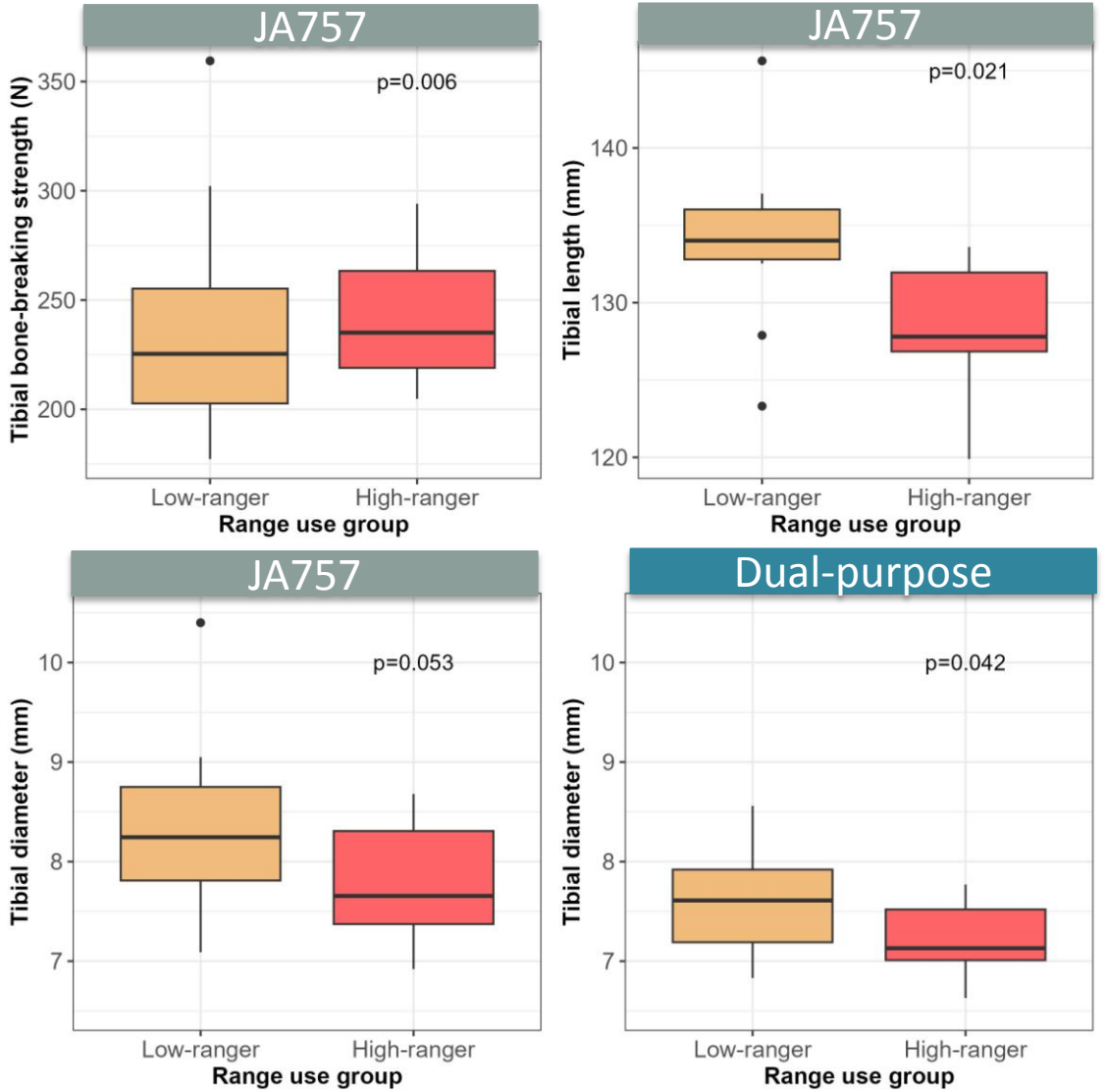
Range use

locomotor activity?

Tibial bone-breaking strength

Tibial length

Tibial diameter



Decreased length and stronger tibial bone in chickens in free-range compared to indoor systems (Fanatico et al., 2005; Stadig et al., 2016)
Decreased tibial length association with forced exercise (Foutz et al., 2007)

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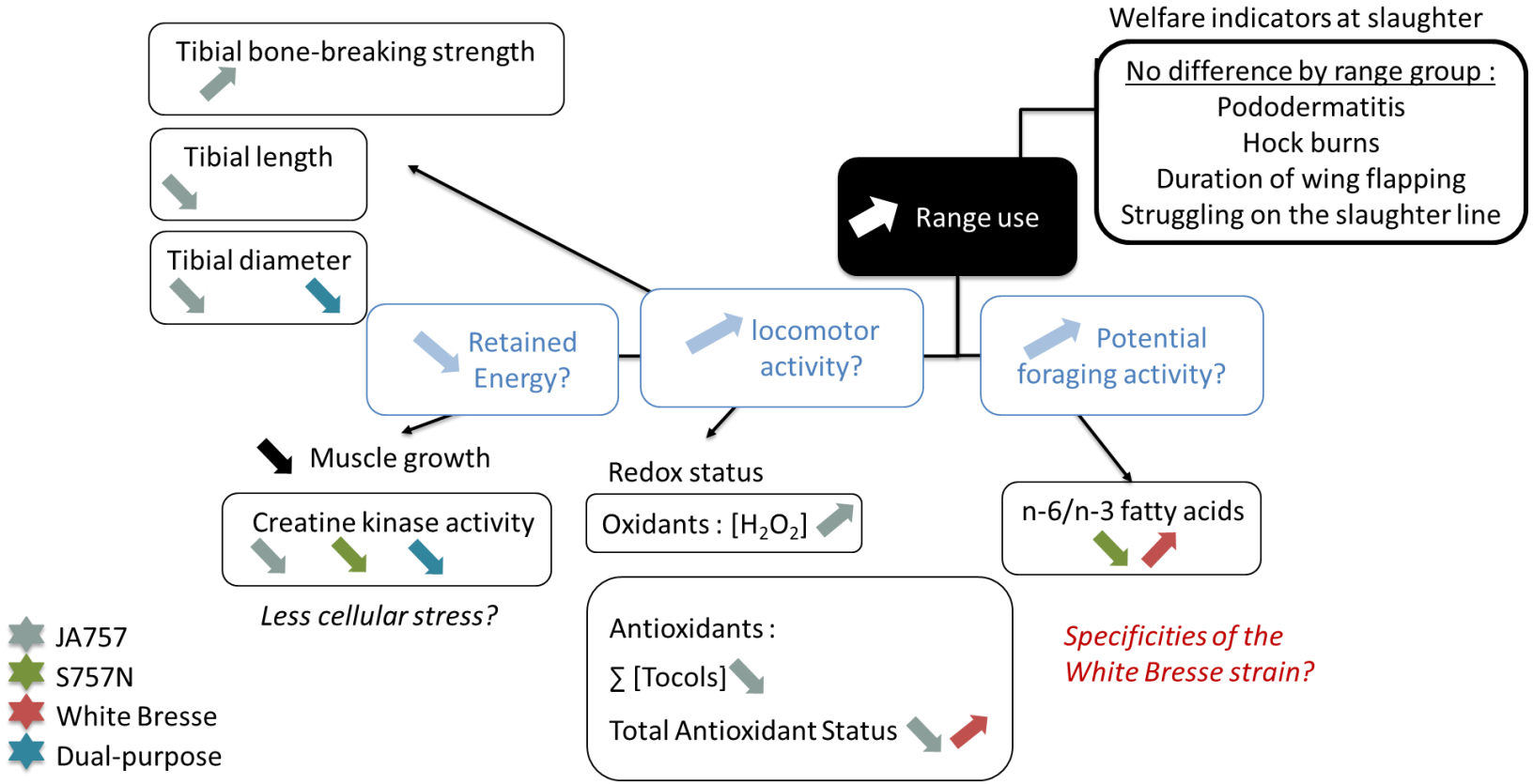
PPILOW Conclusions

- Little effect of greater range use in slow-growing birds on welfare and meat quality indicators except meat yellowness
- Confirmed negative relationship of high range use with performance
- Strain-dependent effects on redox status and blood fatty acids, bone and muscle health
- Many effects observed in JA757: highest growth rate and largest HR/LR Final distance index ratio



Genetic selection possibilities to obtain a compromise between ranging behaviour, performance and health?

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PPILOW **PARTNERS**

Thank you for your attention

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