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



**C. Bonnefous¹, A. Collin¹, L.A. Guilloteau¹, K. Germain², S. Mignon-Grasteau¹, M. Reverchon³, S. Mattioli⁴,
C. Castellini⁴, V. Guesdon⁵, L. Calandreau⁶, C. Berri¹, E. Le Bihan-Duval¹**

¹ INRAE, Université de Tours, BOA, 37380 Nouzilly, France

² INRAE, UE EASM, Le Magneraud, CS 40052, 17700, Surgères, France

³ SYSAAF, Nouzilly, France

⁴ Department of Agricultural, Environmental and Food Science, University of Perugia, Borgo XX Giugno 74, 06124, Perugia, Italy

⁵ Junia Hauts de France, ISA Lille, 48 Boulevard Vauban, BP 41290, 59014 cedex Lille, France

² INRAE, CNRS, IFCE, Université de Tours, PRC, 37380, Nouzilly, France

74 annual meeting – EAAP, Lyon

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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

PPILOW Method – Experiment from February until June 2021

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

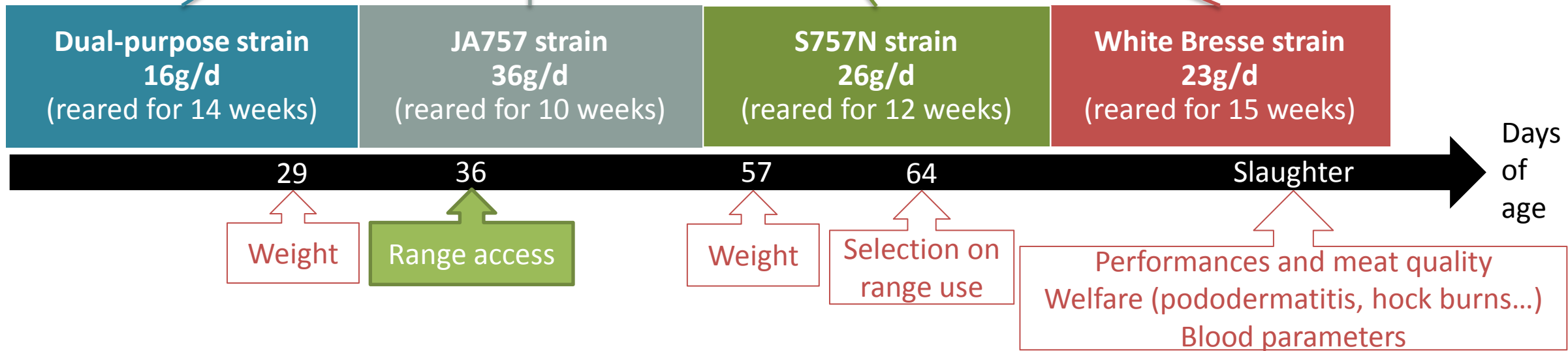
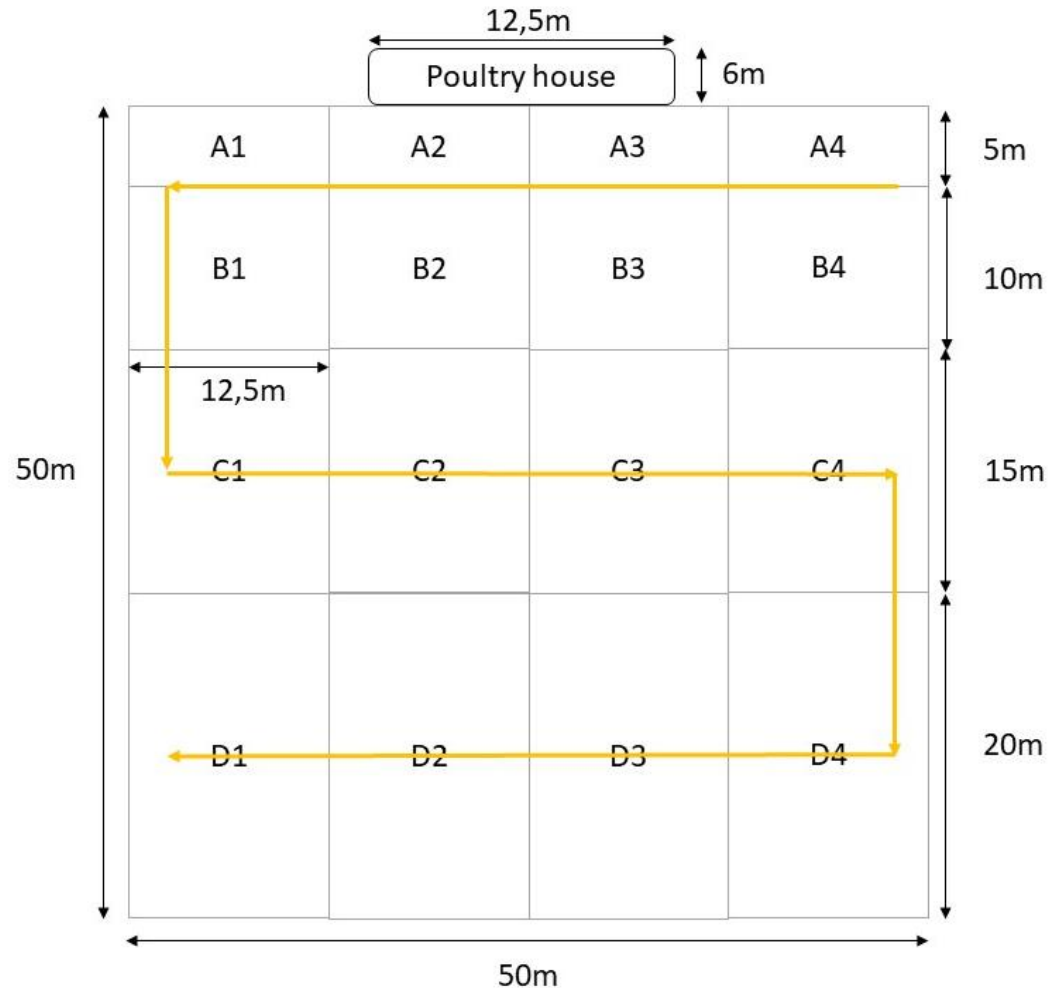


FIGURE OF SCAN SAMPLING : ← Observer's path



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 =

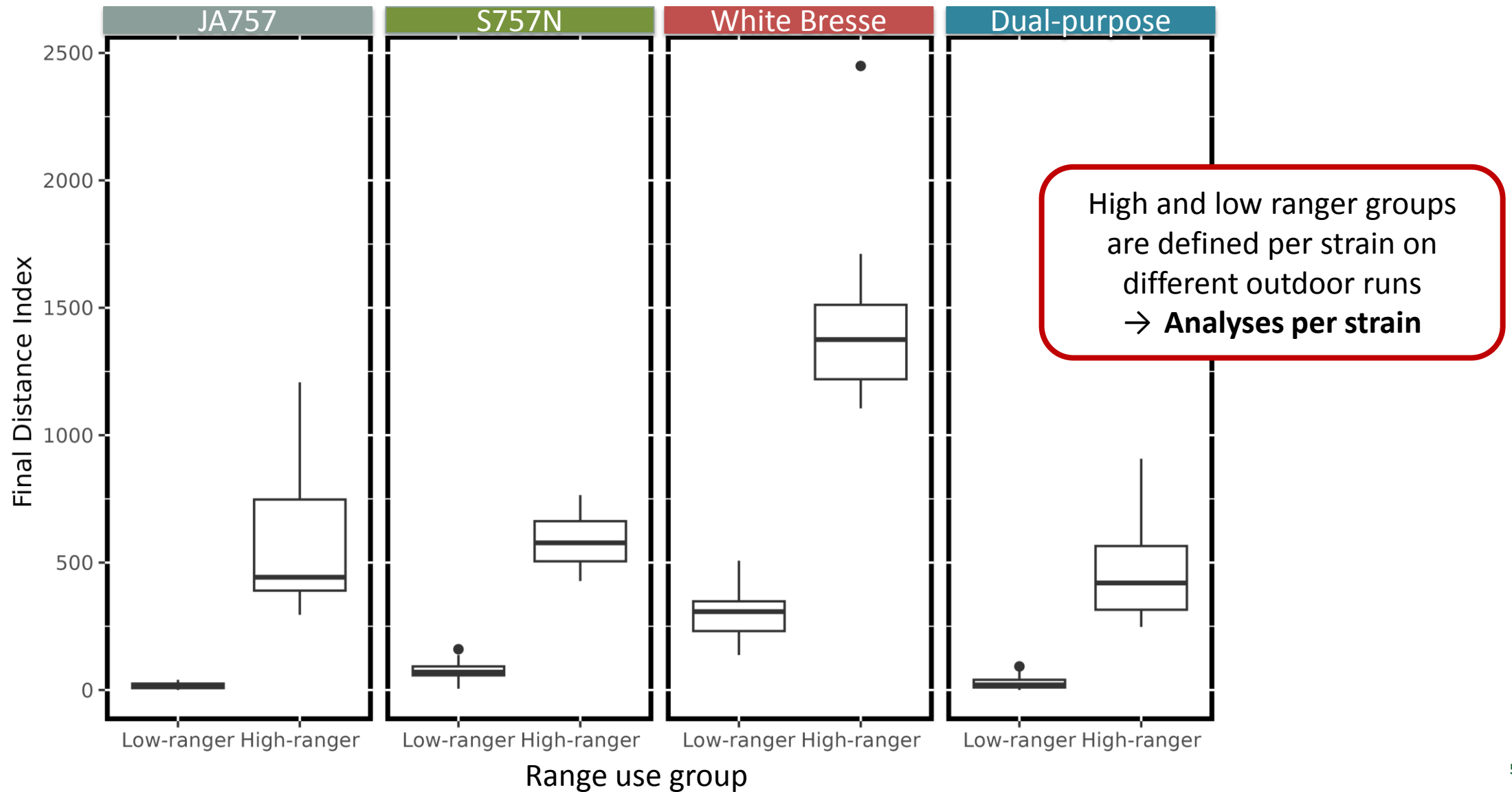
number of times recorded in zone A * 2.5 +
number of times recorded in zone B * 10 +
number of times recorded in zone C * 22.5 +
number of times recorded in zone D * 40

Selection :

25 animals with the lowest final distance index
= low-rangers

25 animals with the highest final distance index
= high-rangers

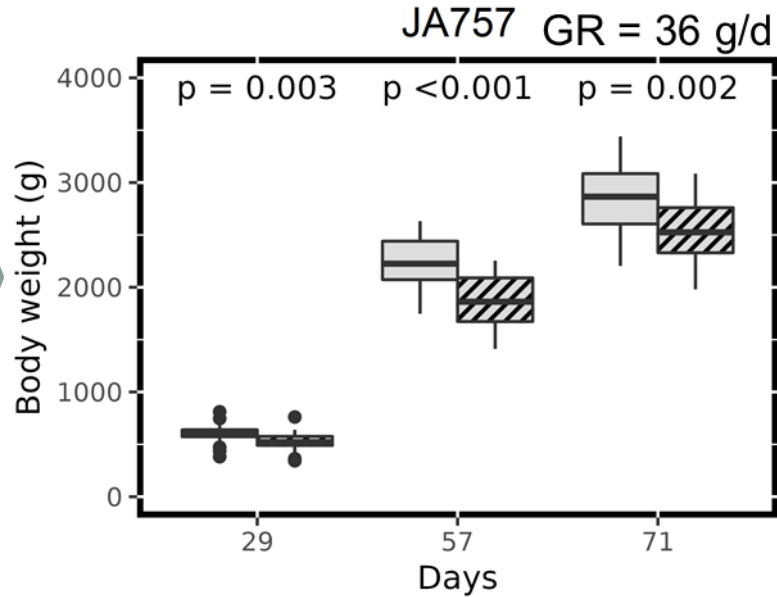
PPILOW Method – Experimentation from February until June 2021



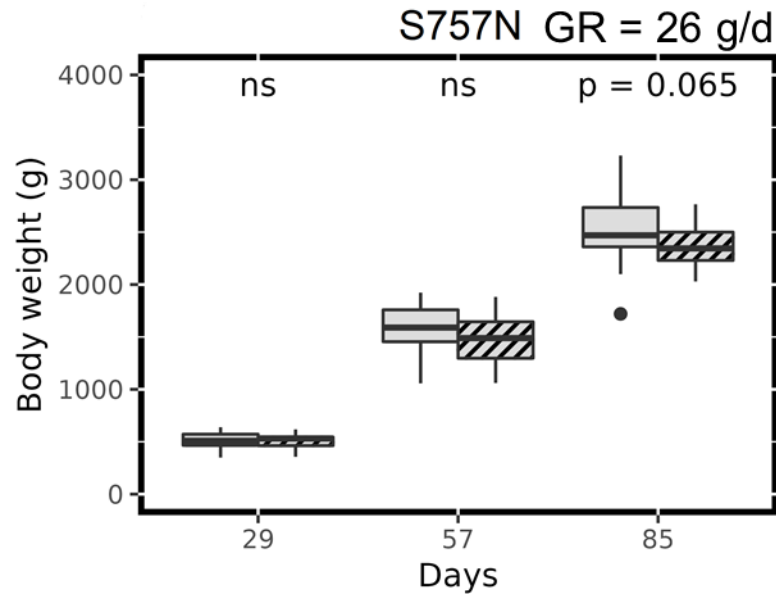
PPILOW Results Performance : growth

Low-rangers
High-rangers

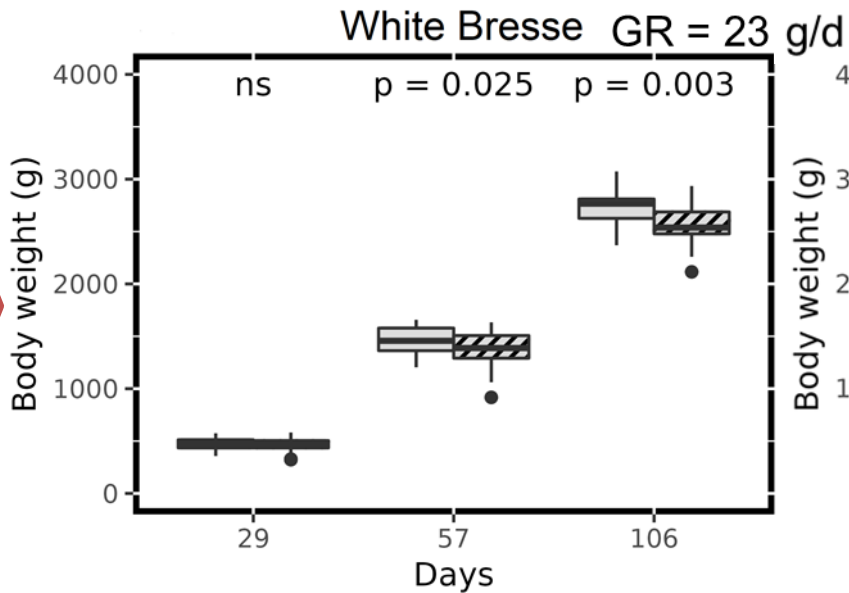
Differential body weight may be partly a cause of differential range use?



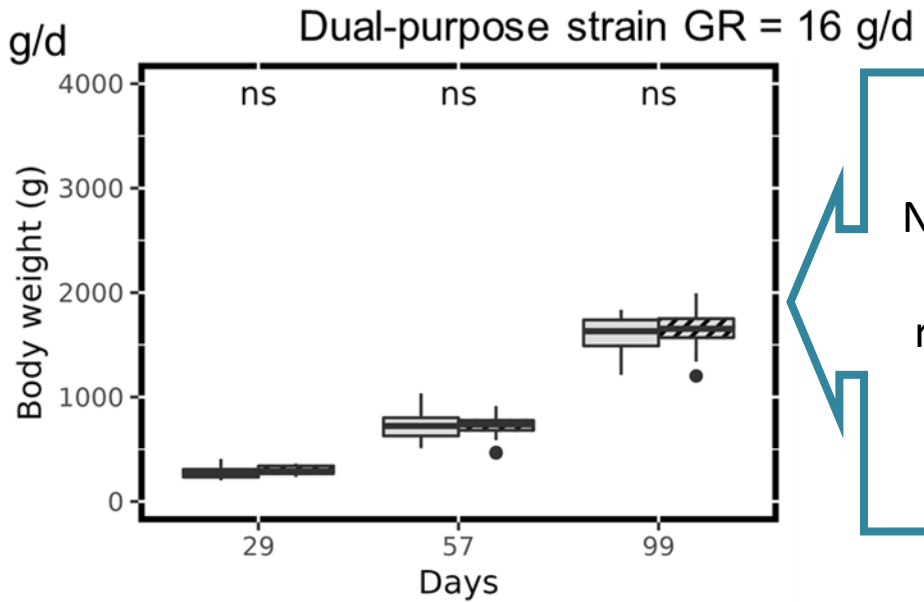
Differential body weight may be a consequence of differential range use?



Differential body weight may be a consequence of differential range use



No relationship between range use and body weight



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)

- 
- Range use

Retained Energy?

Creatine kinase activity

JA757

Y-axis: Creatine Kinase activity (U/L)

X-axis: Range use group

Groups: Low-ranger, High-ranger

p=0.003

Range use group	Min	Q1	Median	Q3	Max	Outliers
Low-ranger	2800	3900	5100	5800	7700	None
High-ranger	3300	3400	4100	4600	5600	6700

S757N

Y-axis: Creatine Kinase activity (UI/L)

X-axis: Range use group (Low-ranger, High-ranger)

p=0.054

Range use group	Min	Q1	Median	Q3	Max	Outliers
Low-ranger	2100	3100	3700	4300	5200	6300
High-ranger	2000	2900	3200	3500	4000	4600, 6100

Dual-purpose

Creatine Kinase activity (UI/L)

8000

6000

4000

2000

Low-ranger High-ranger

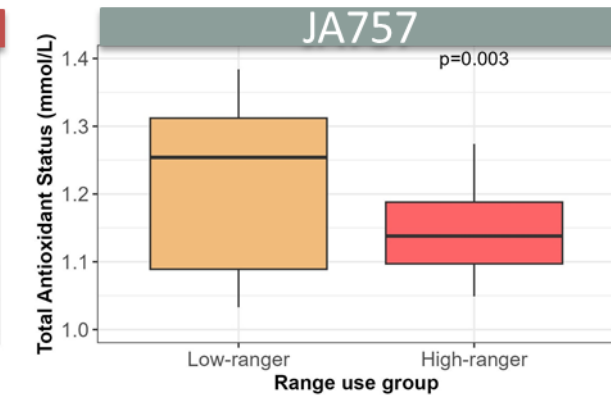
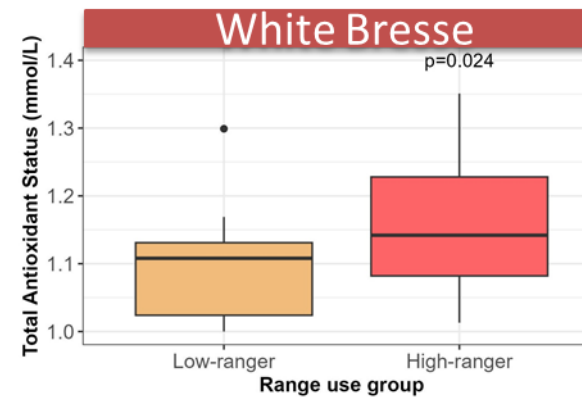
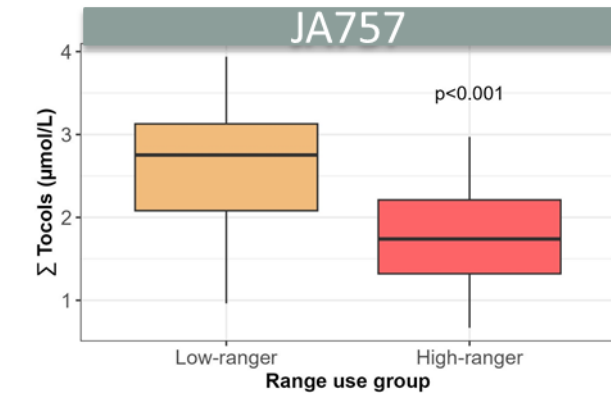
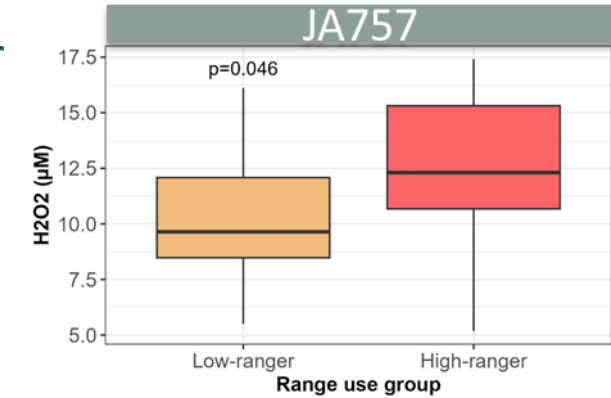
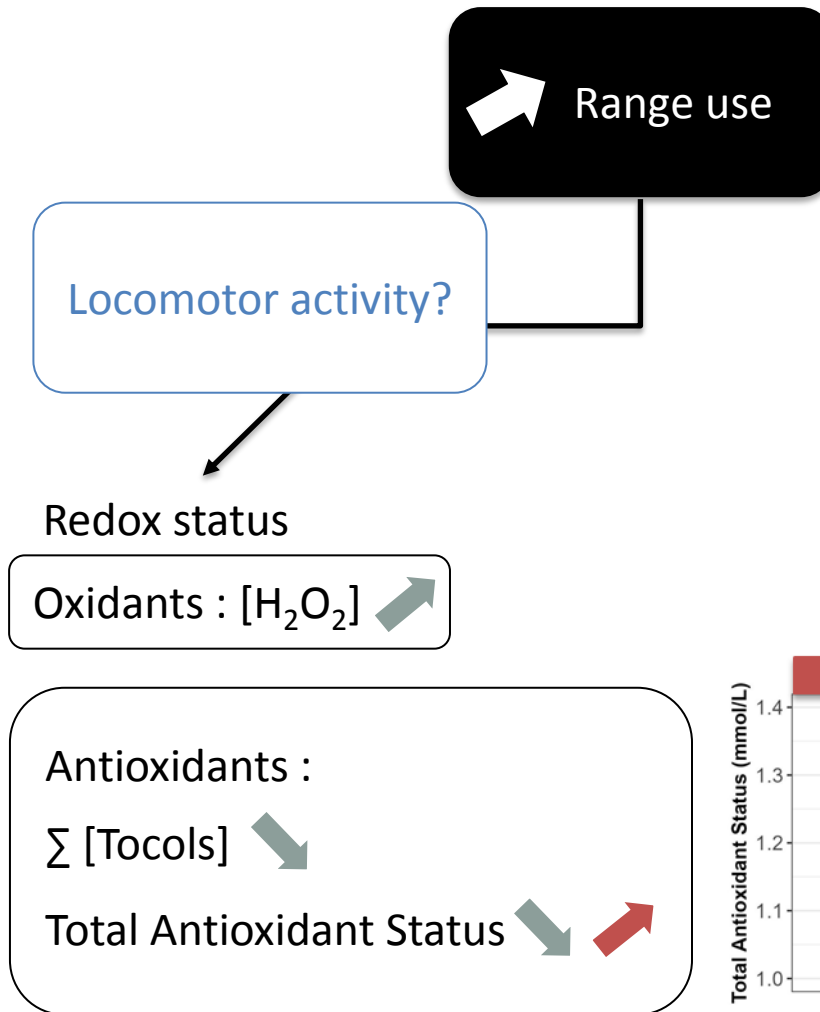
Range use group

$p=0.007$

Range use group	Min	Q1	Median	Q3	Max	Outliers
Low-ranger	3000	4000	4500	5100	6700	6800
High-ranger	2800	3200	3500	3700	4300	2500, 5600

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

- ★ JA757
- ★ S757N
- ★ White Bresse
- ★ Dual-purpose



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

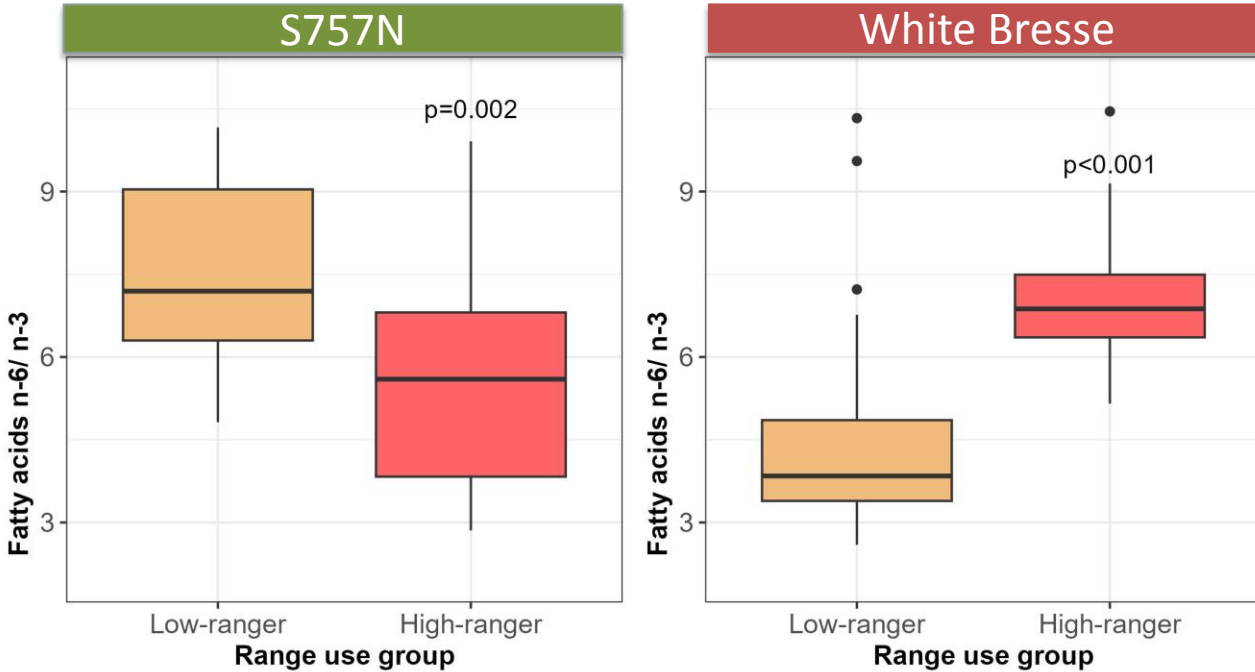
PPILOW Results Physiology and metabolism : blood parameters at slaughter

- ★ JA757
- ★ S757N
- ★ White Bresse
- ★ Dual-purpose

Range use

Potential foraging activity?

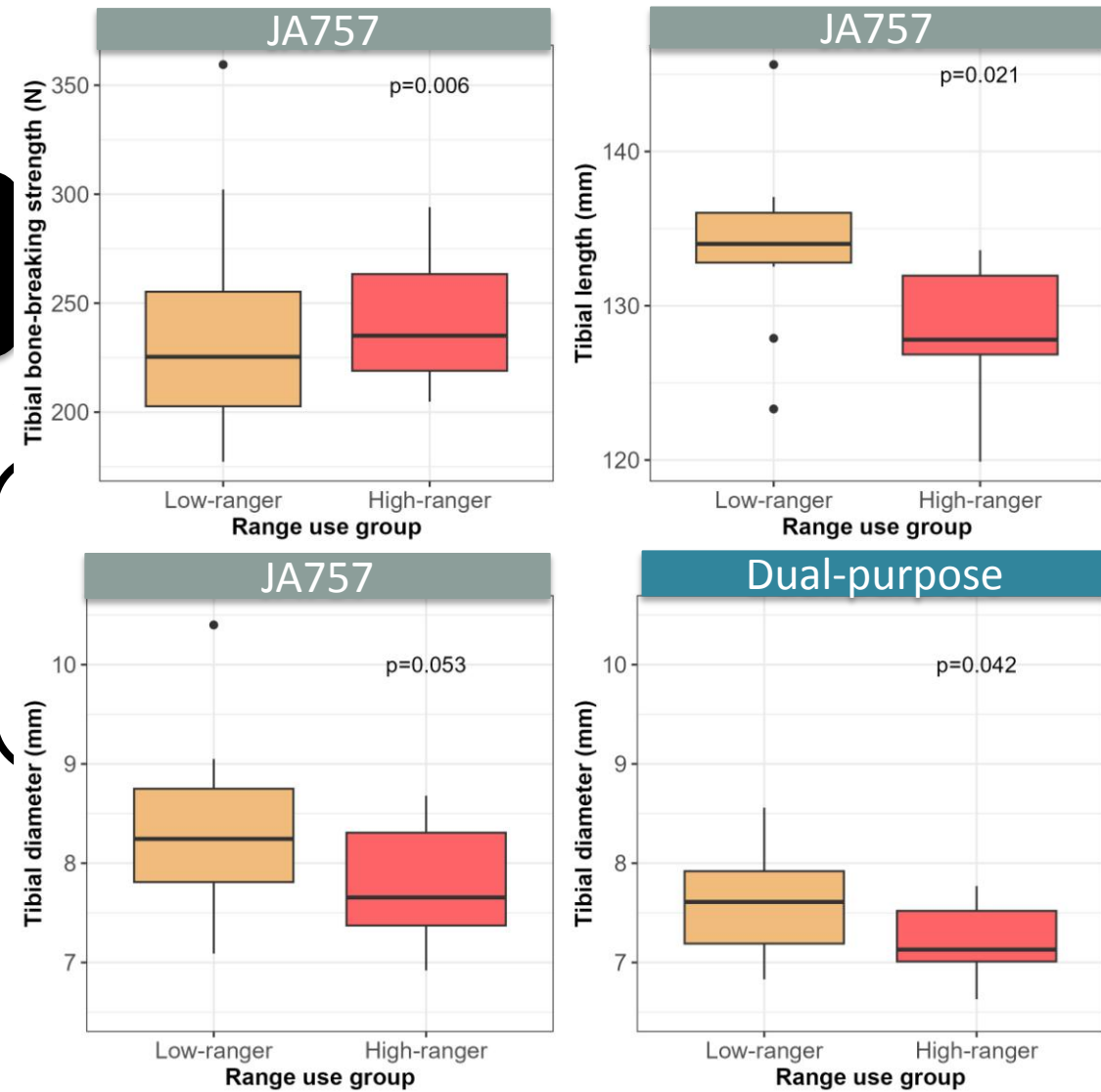
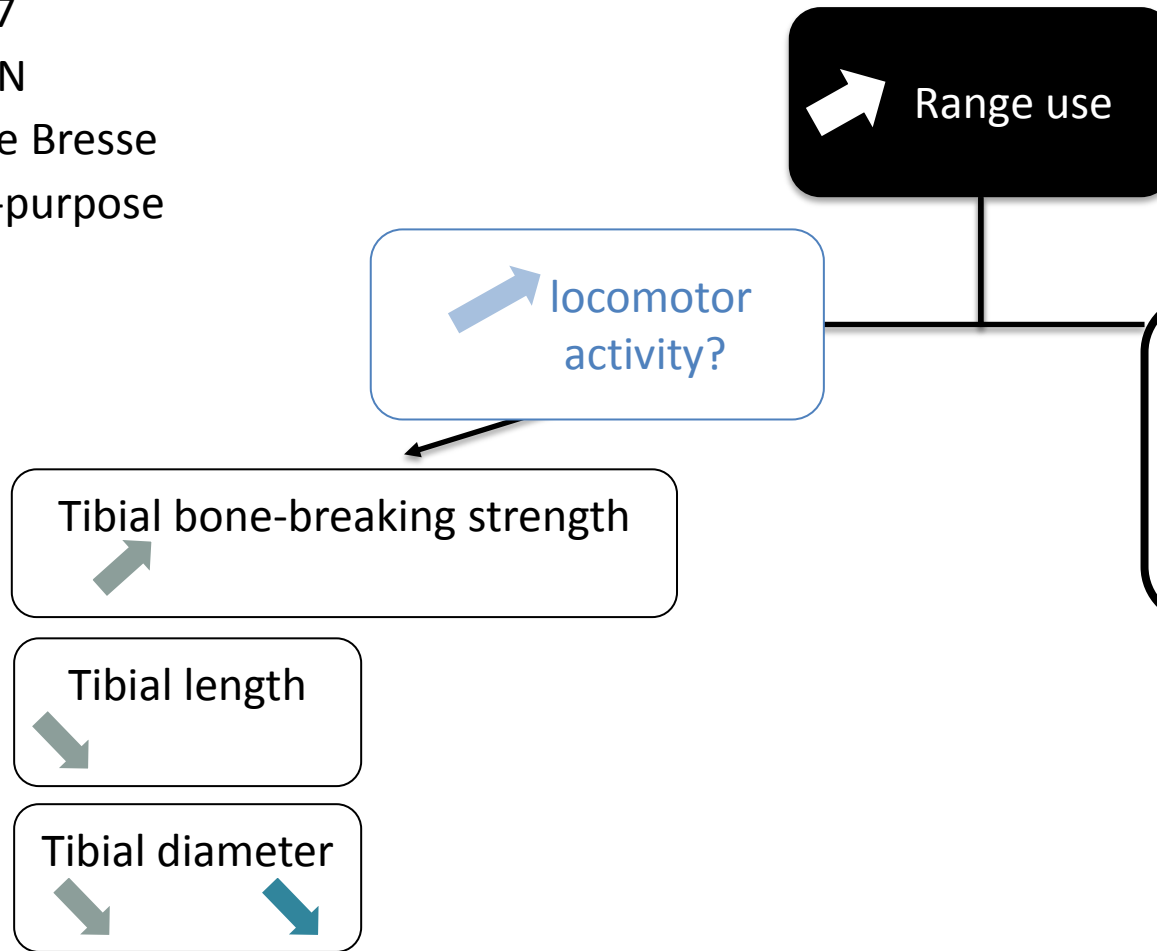
n-6/n-3 fatty acids



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)

PPILOW Results Health and Welfare

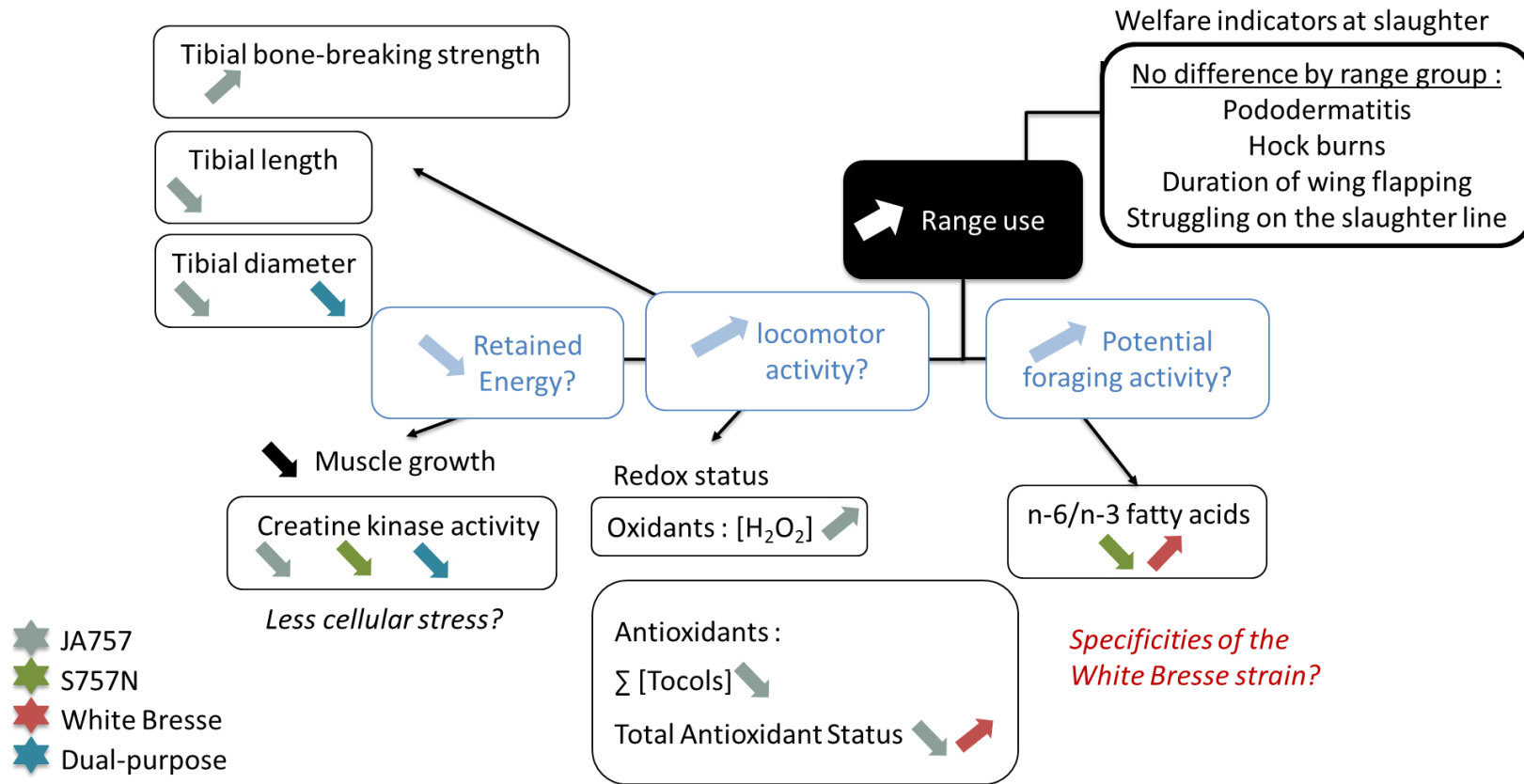
- JA757
- S757N
- White Bresse
- Dual-purpose



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)

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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