



Day 2 - Session: Co-adapted systems, genotypes and animals

Expected/real improvement of outdoor use and pasture enrichment in chicken

Cesare Castellini & co.

Department of Agricultural, Food and
Environmental Sciences (DSA3), University of
Perugia
Italy



Cesare Castellini



Alessandro Dal Bosco



Simona Mattioli



Alice Cartoni Mancinelli



Elisa Angelucci



Diletta Chiattelli



State of the art

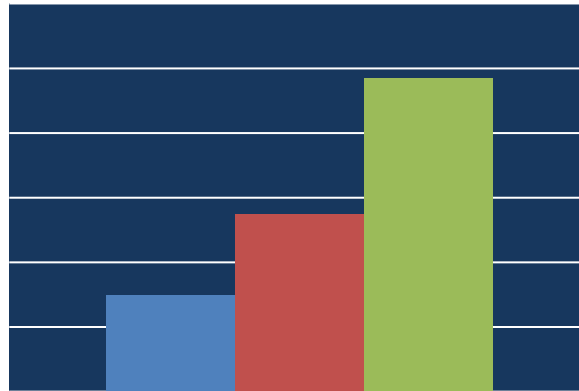
Avrei bisogno dell'indirizzo email perché
devo inviare dei form da riempire.

pre-ppillow state

Welfare-oriented market

EU CITIZENS

Free-range
Local feeds
«Happy animals»



FreeRange & organic

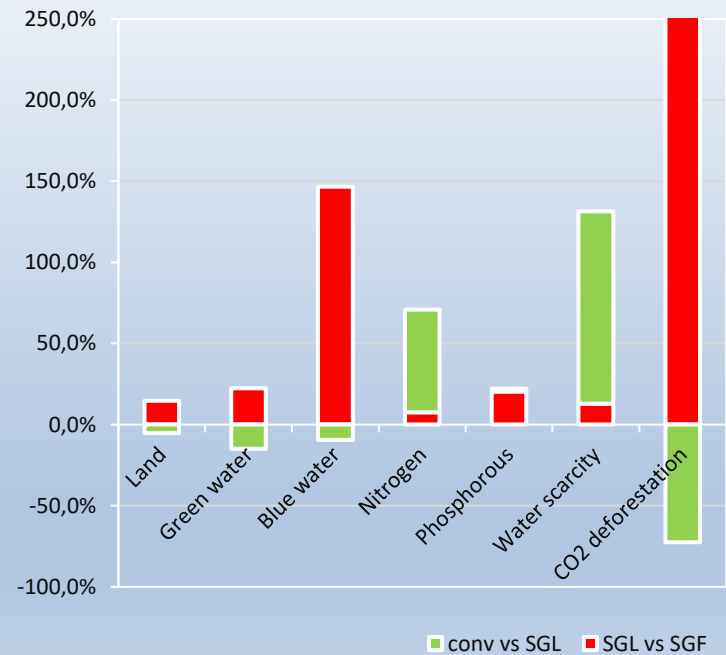
ENERGY EXPENDITURE

- > Kinetic activity
- > Thermoregulation
- > Immune response

> LAND-USE

combination
animals/crop/trees

Environmental comparisons



Interaction animals, grass and plants

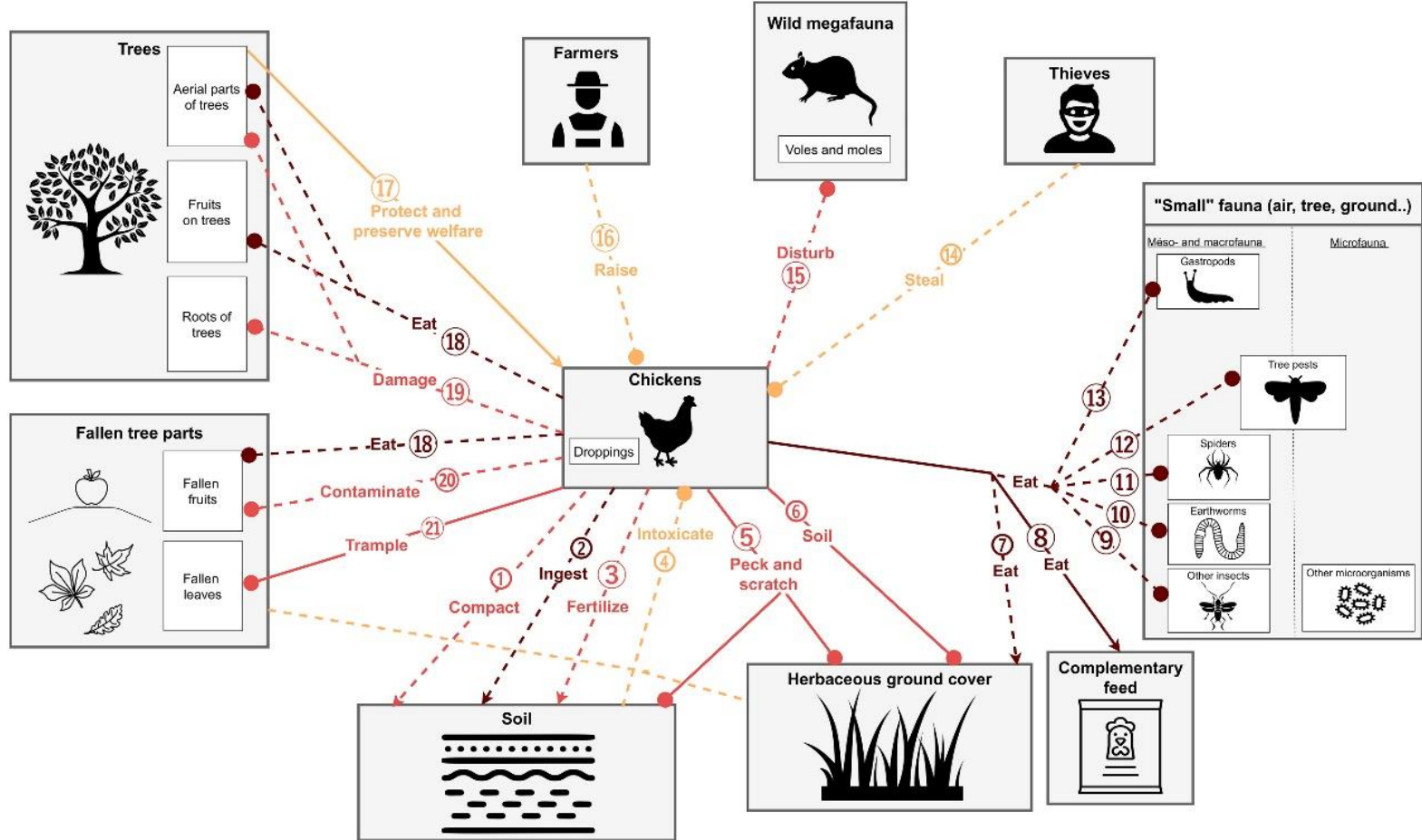












LEGEND

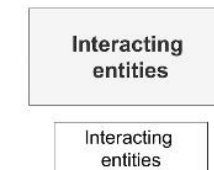
TYPE OF INTERACTION

-Eat-	Nature of interaction
	Chickens' welfare and health
	Chickens' nutrition
	Physical, biological and chemical impact of chickens

NATURE OF INFORMATION

①	Associated number
→/●	Quantification / No quantification of the interaction
—/.....	Agreement / No agreement between sources

COMPARTMENTS



(Icons credit : the Noun Project)

MAIN EFFECT

animal welfare and characteristic of product

whole agro-system

Environmental impact

Fertilization and weeding

(1000 chickens Ha -100-150 kg N, 150-200 kg P_2O_5)

Soil structure

Crop and tree production



Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Combining livestock and tree crops to improve sustainability in agriculture: a case study using the Life Cycle Assessment (LCA) approach

Land use	-18%
Environmental impact	-30%

Soil structure



SITE ²	Cmic	ΣCO ₂ -C	Cmic/TOC Ratio
Horizons	mg kg ⁻¹	mg kg ⁻¹	
HGD			
Ap1	1705 (213) ^{ab}	420 (11) ^c	0.12 (0.00) ^{ab}
Ap2	1255 (58) ^{ab}	584 (15) ^b	0.13 (0.00) ^{ab}
LGD			
Ap1	2229 (453) ^a	644 (16) ^b	0.22 (0.05) ^a
Ap2	1827 (170) ^a	315 (2) ^d	0.27 (0.06) ^a
WG			
Ap1	1041 (113) ^{bc}	875 (32) ^a	0.08 (0.01) ^b
Ap2	796 (19) ^c	326 (2) ^d	0.09 (0.01) ^b

- Animal density is important (LD > HD)
- Better adaptation of the microbial community with geese (> microbial biomass, low CO₂-C during basal respiration)
- Higher substrate-use efficiency of the microbial community (Cmic/TOC)

In Italy 1 milion ha olive trees and marginal landscape are at risk



Grape production

	Kg grape per plant	Weight of bunch (g)	Nitrogen readily available (mg/l)
GEESE	2,1 a	219 a	142 a
NO GEESSE	1,7 b	174 b	106 b

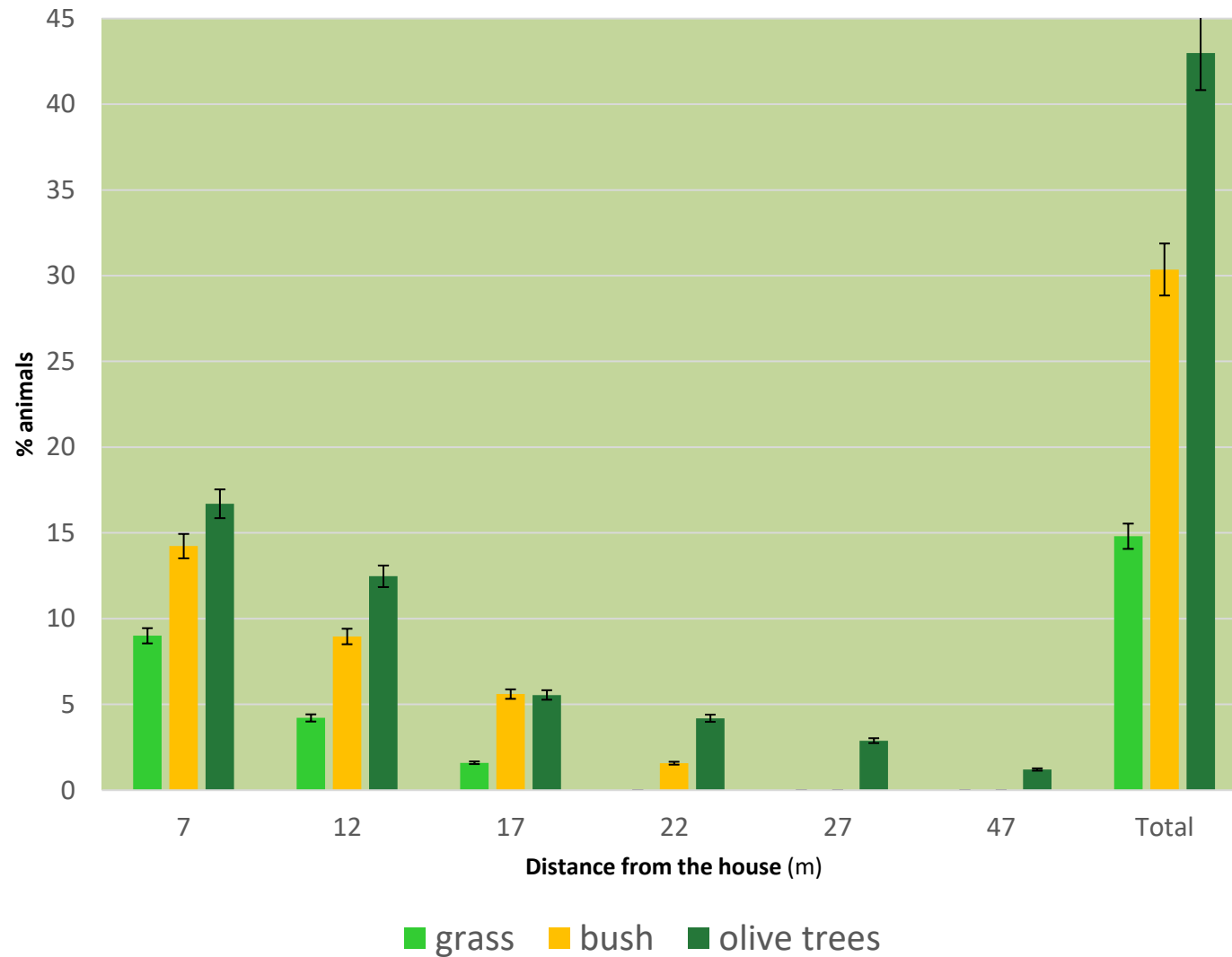


Control of plant diseases

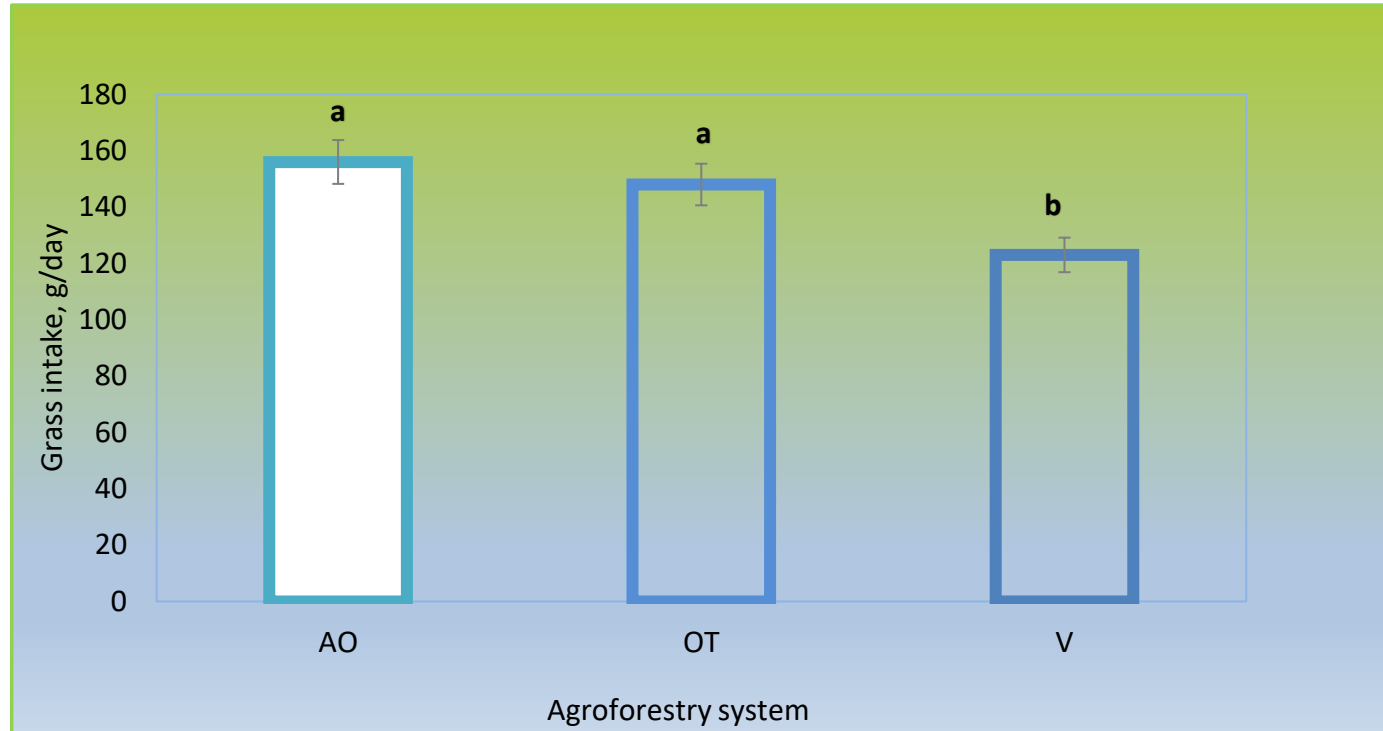


Active behaviour

Grass intake (g/d) of chickens



Grass intake in the geese reared in the three agroforestry systems



a,b Means with different letters differ significantly ($P \leq 0.05$)



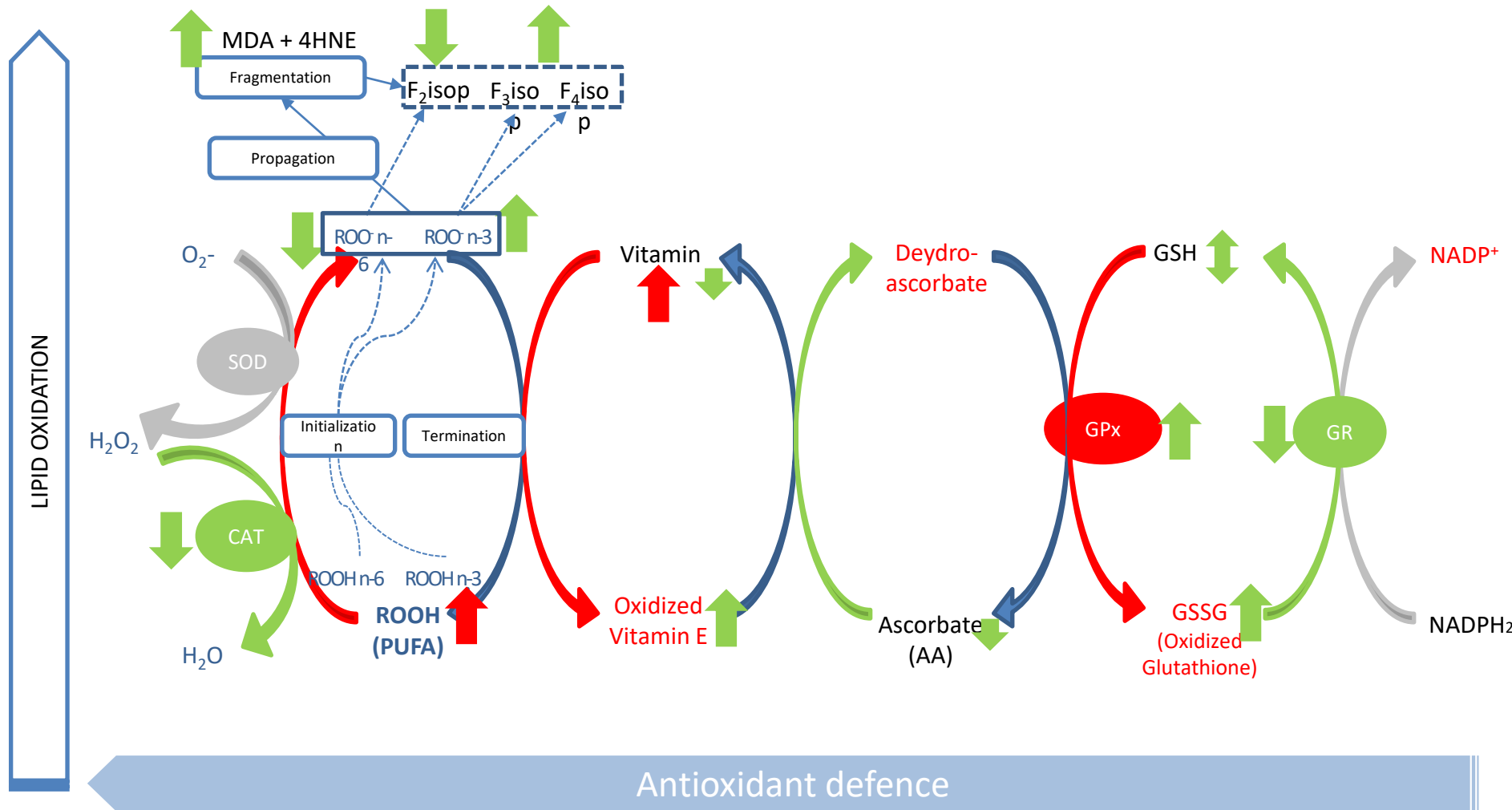


CONCLUSIONS CHICKEN BEHAVIOUR

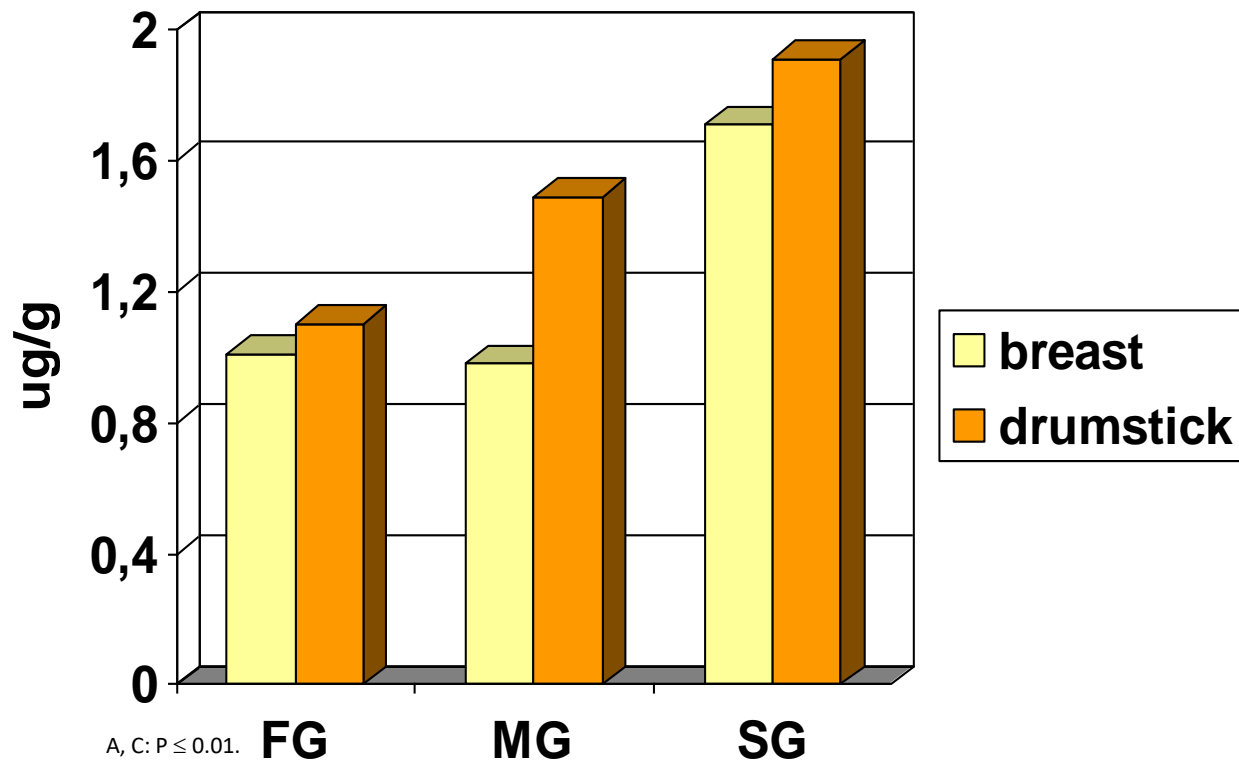
- ✓ Enrichments improves the pasture use - not only in term of grass intake but also regarding the distance from house
- ✓ When possible trees should be preferred
- ✓ The magnitude of improvement is affected by genetic strain

Meat quality

Interaction PUFA pro-anti-oxidants



α -tocoferol in breast and drumstick of chicken

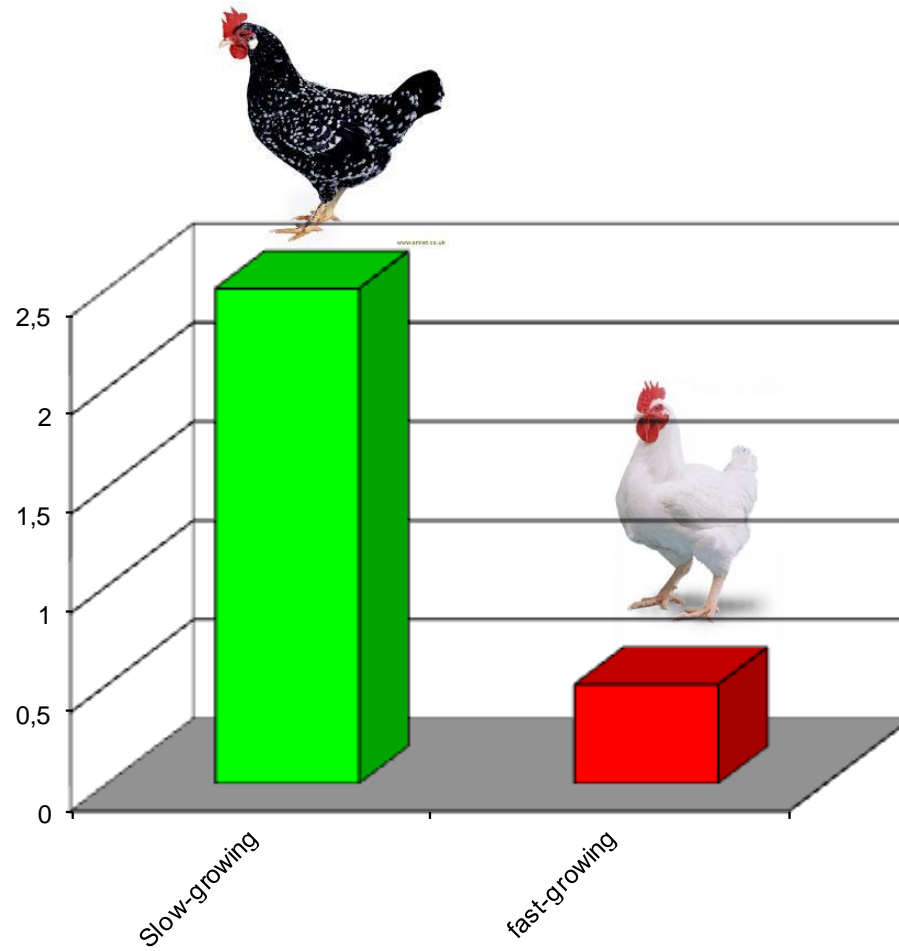


Oxidative status and main antioxidants of breast and drumstick in three agroforestry systems: apple orchard (AO), olive trees (OT) and vineyard (V)

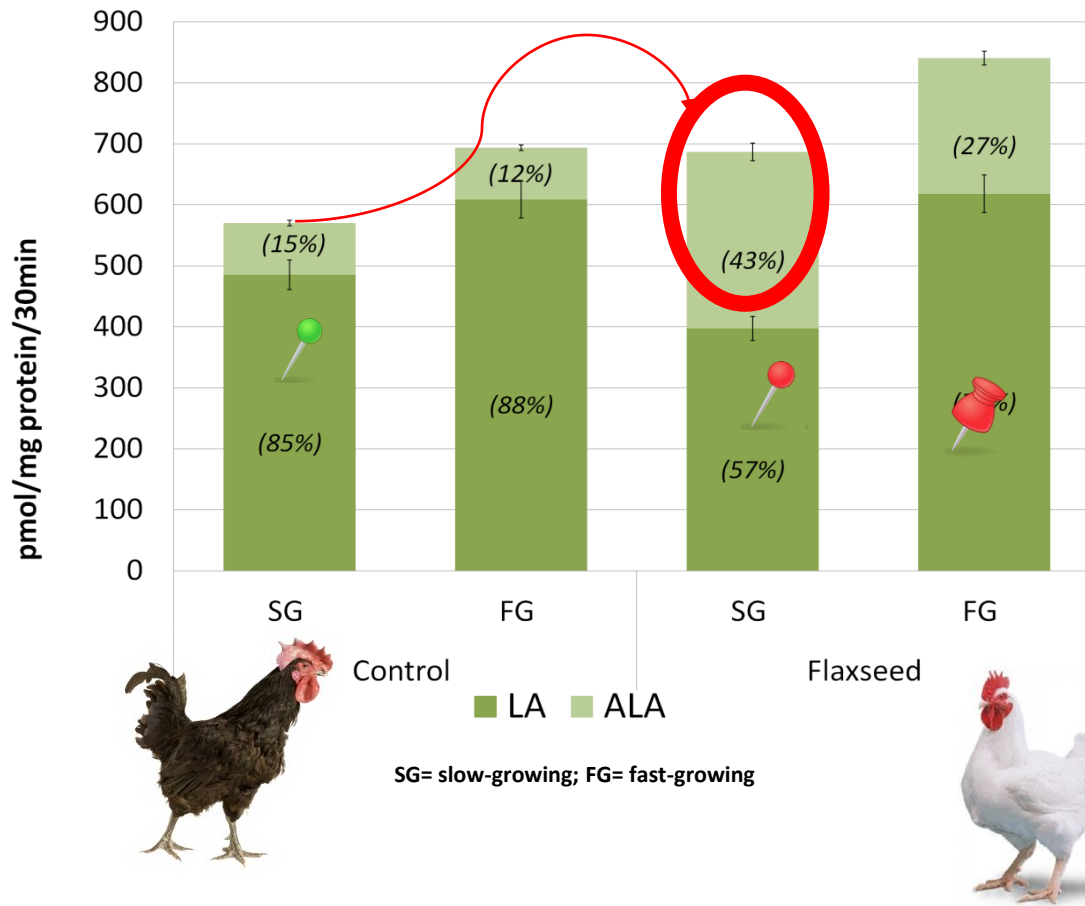
	Agroforestry system					
		C	AO	OT	V	Signif.
<i>Pectoralis major</i>						
Σ Tocopherols	μg/g	2.20 ^b	4.11 ^a	5.96 ^a	1.17 ^b	*
Σ Antioxidants	μg/g	10.26 ^c	18.17 ^b	27.28 ^a	14.70 ^a	*
TBARS	μg MDA/g	0.20 ^b	0.43 ^a	0.37 ^a	0.24 ^b	*
<i>Biceps femoris</i>						
Σ Tocopherols	μg/g	0.92 ^d	3.26 ^a	2.56 ^b	2.02 ^c	**
Σ Antioxidants	μg/g	19.28	25.13	23.47	23.40	n.s.
TBARS	μg MDA/g	0.24 ^b	0.55 ^a	0.45 ^a	0.22 ^b	*

Σ Antioxidants - tocopherols (α- β+γ and δ tocopherol) + α-tocotrienol + retinol; TBARS – thiobarbituric acid reactive substances; MDA – malondialdehyde

LCP n-3 in breast meat



$\Delta 6$ -desaturase activity of SG e FG



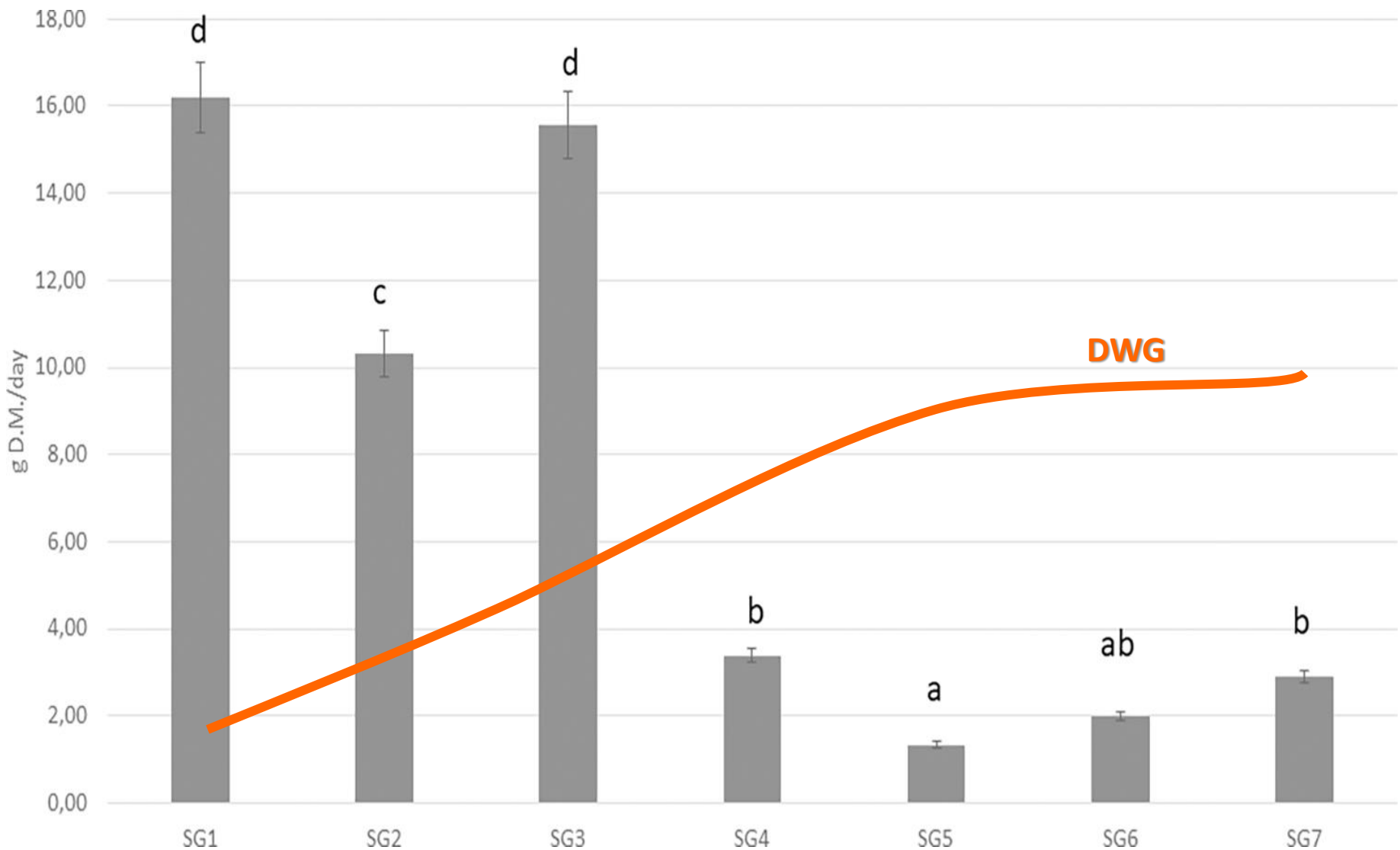
ASSUMPTIONS MEAT QUALITY

- ✓ Kinetic activity and foraging behaviour interact
- ✓ More foraging behaviour > adaptation
- ✓ The behaviour affects the intake and metabolism of bioactive compounds (PUFA, desaturase, antioxidant)
- ✓ Balance between PUFA-ROS-ANTIOX (?)

PPILOW results

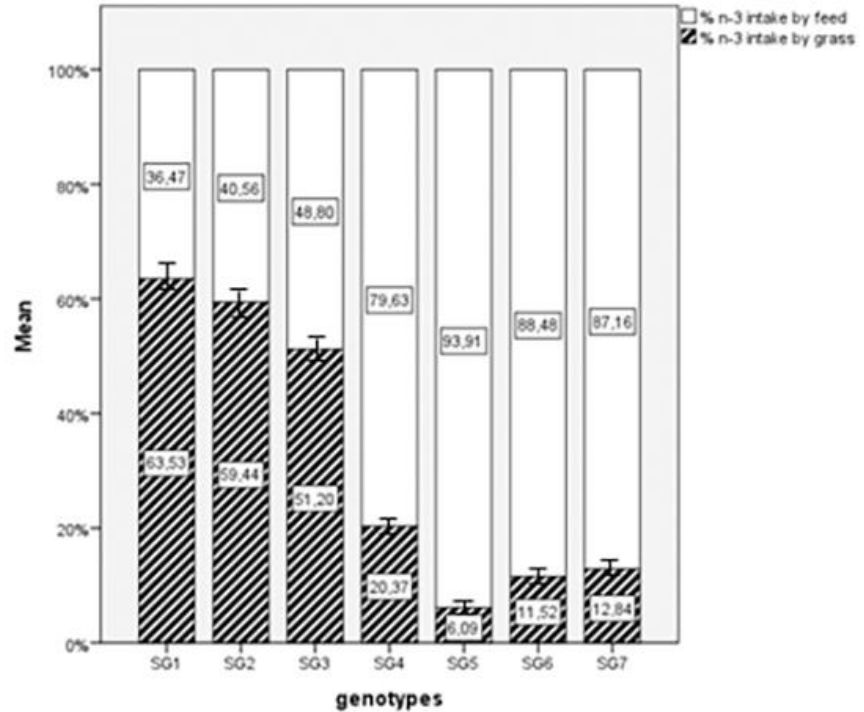
- 1. Forage behavior, grass and n-3 intake and body storage in different poultry strains**
- 2. Assessment of simple and reliable methodology for behavior evaluation of chickens outdoor**

Grass intake of different chicken strains

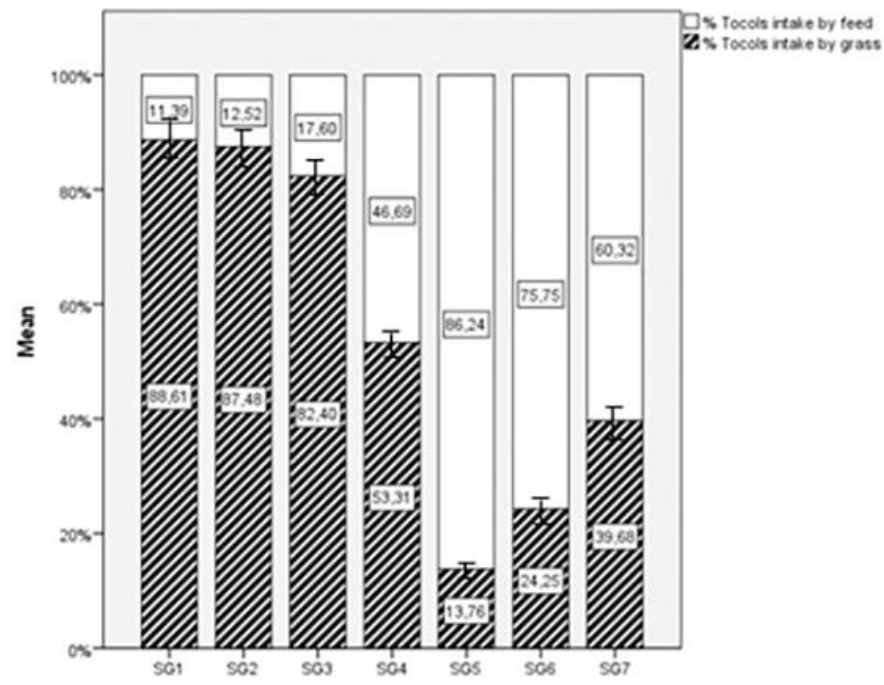


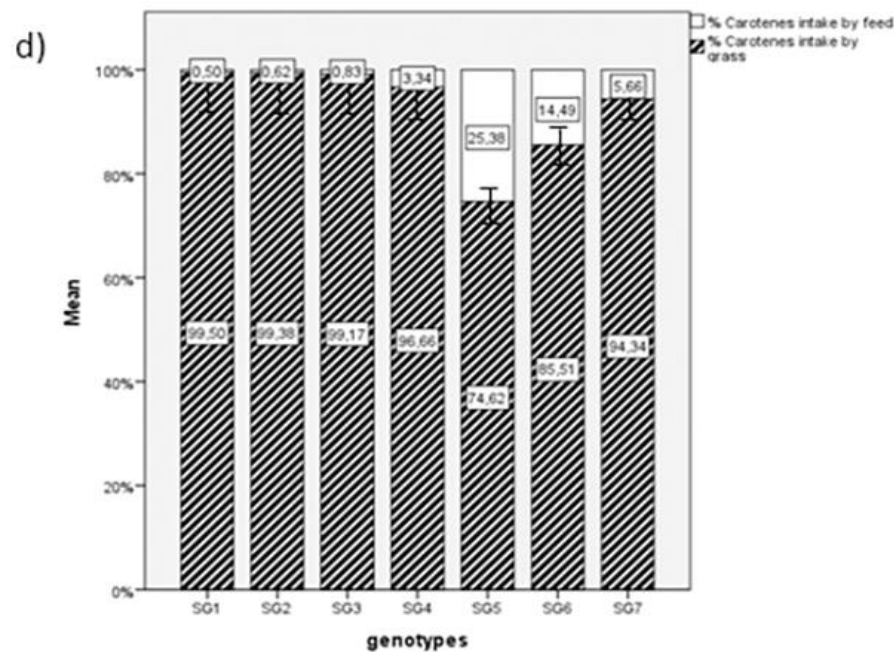
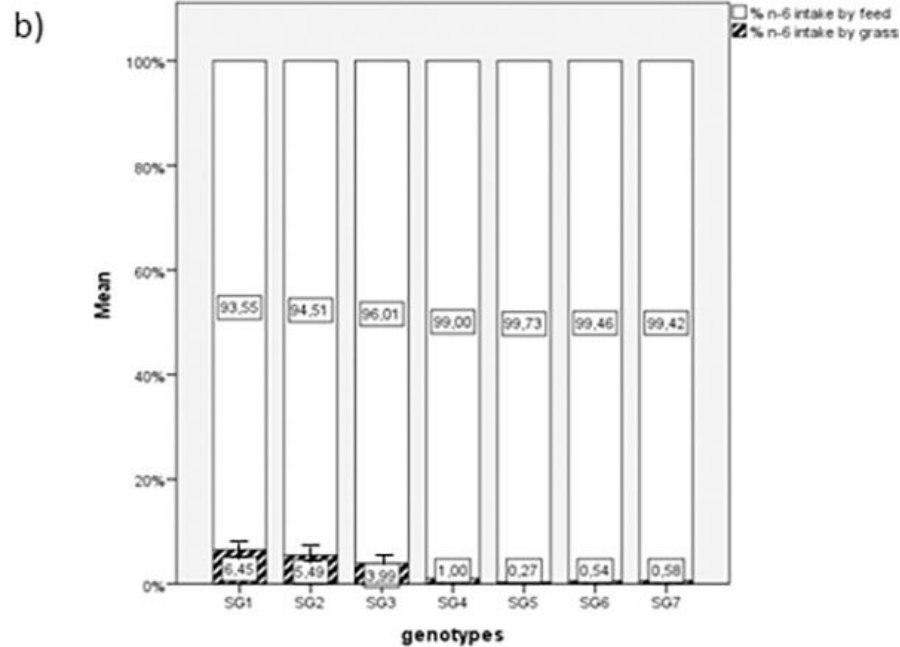
Intake of bioactive compounds (n-3, tocopherols)

a)

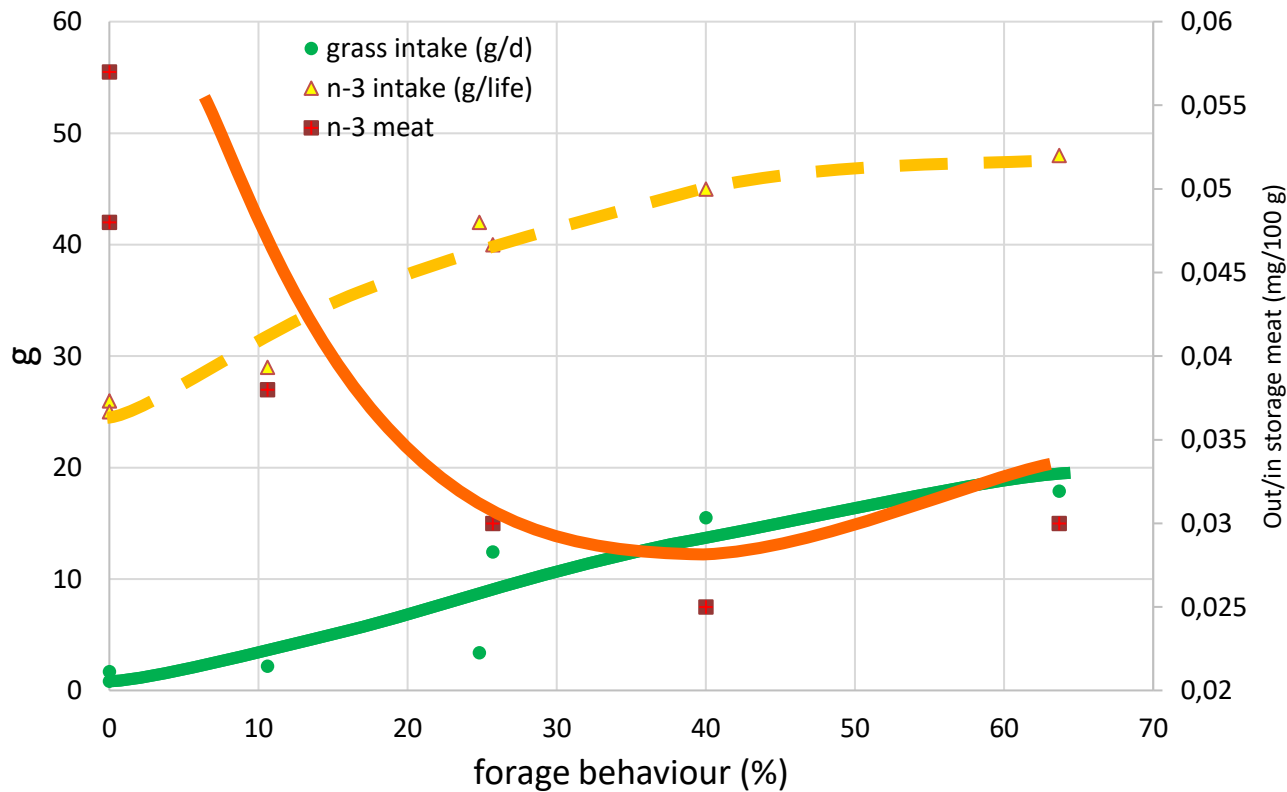


c)





Forage behavior, grass and n-3 intake and body storage in different poultry strains



Metabolism and fat destiny



Local strain

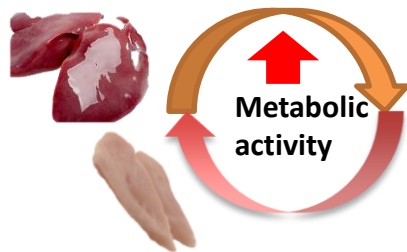


Crossbred

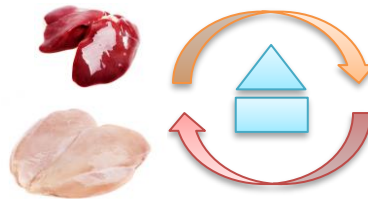


hybrid

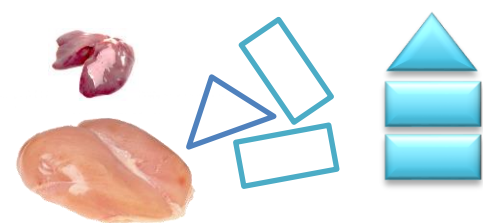
RECYCLE and TURNOVER



INTERMEDIATE trend



STORAGE & STRUCTURE

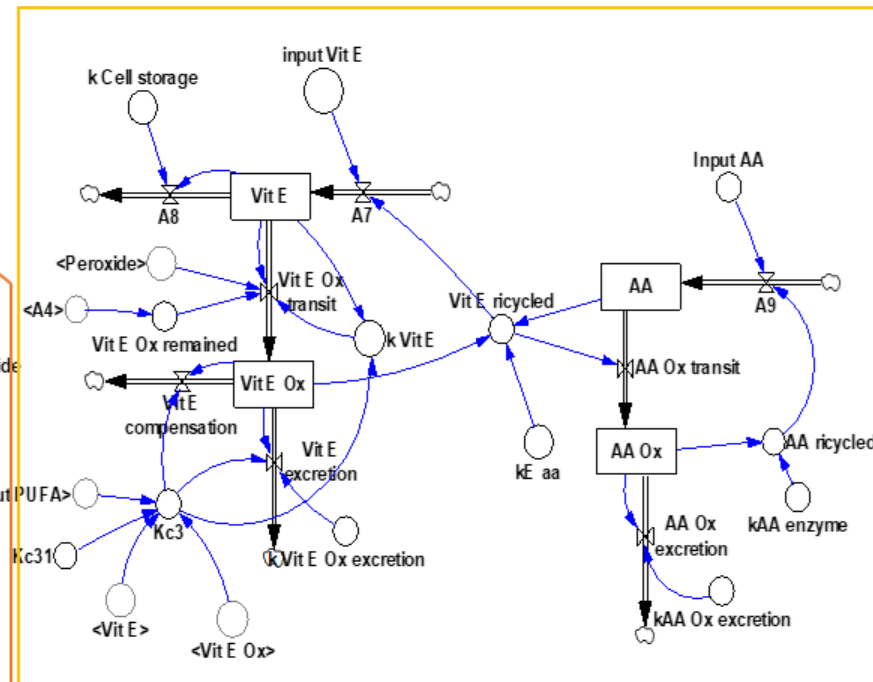
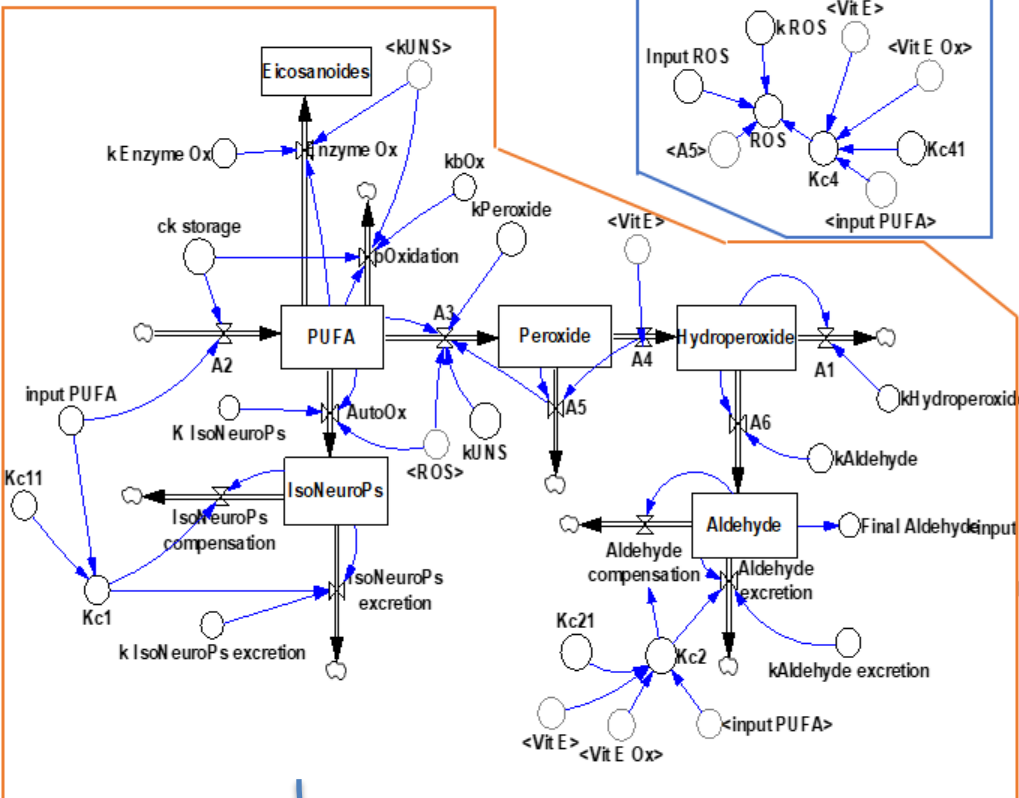


LIVER	n-3 NEFA higher unsaturation (PS)	medium n-6 and n-3 NEFA TG similar to Ross	> TG (PE) (PC) largely unsaturated
MUSCLE	> metabolic activity - kinetic behaviors, health status, immune system	intermediate trend	> muscle lipid and FA concentration energy used for storage

Kinetic Activity (ROMs, antiox. equilibrium)

Energy metabolism
(feed and pasture intake)

Foraging behaviour
(PUFA and antioxidants)



body

meat

Continuos recording is the golden standard for assessing behavioral repertoire

but

**in outdoor (many interactive chickens, large space)
CR is quite impossible**

How the sampling interval affect the results ?

**Therefore, we evaluated the reliability and accuracy
of different sampling intervals (5, 10, 15, and 30
min)**

Percentage (logarithmic scale)

10 min interval
15 min interval
30 min interval

10.00

1.00

0.00

Low

Medium

High

Occurrence category

ns

a

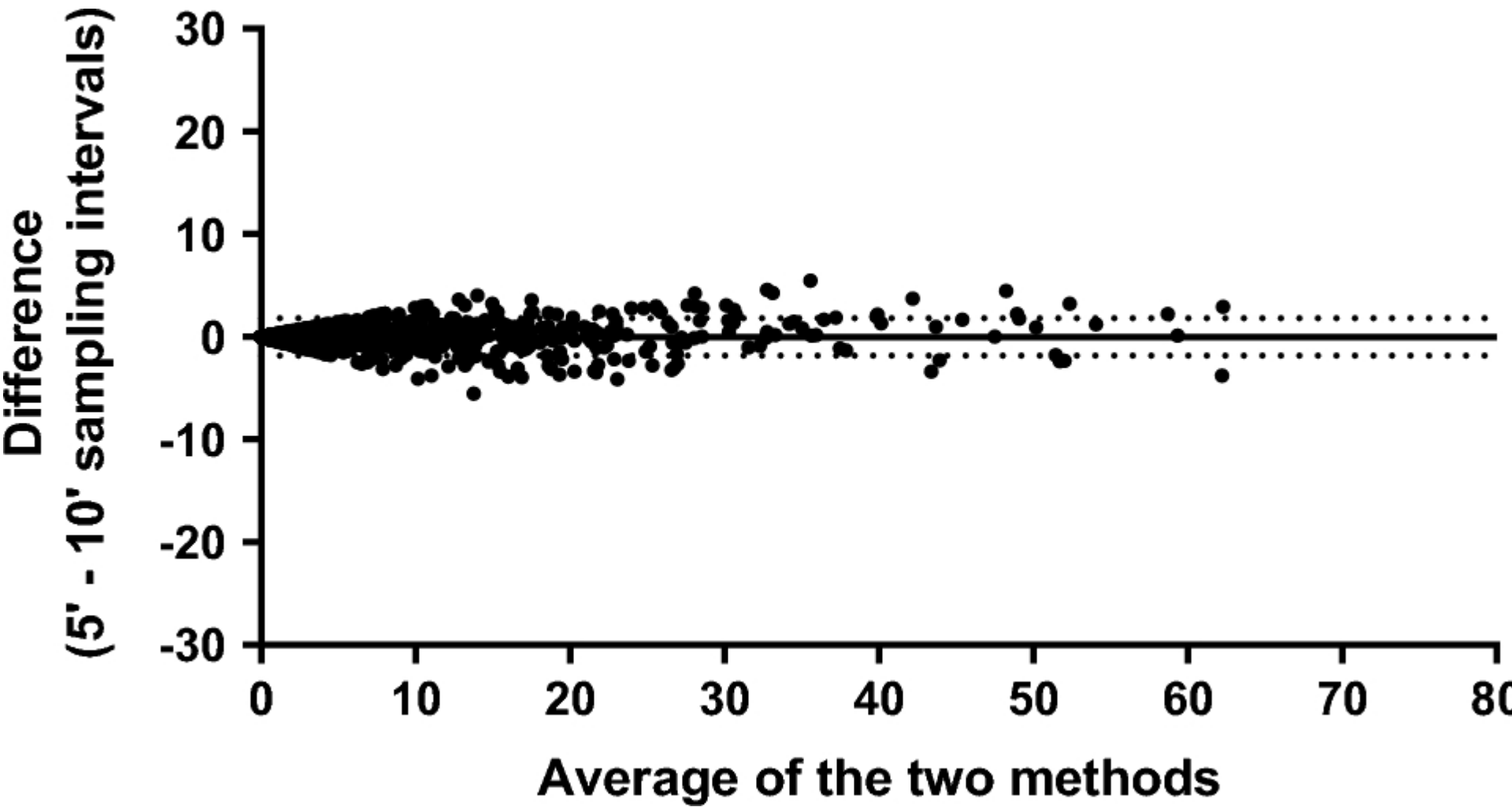
b

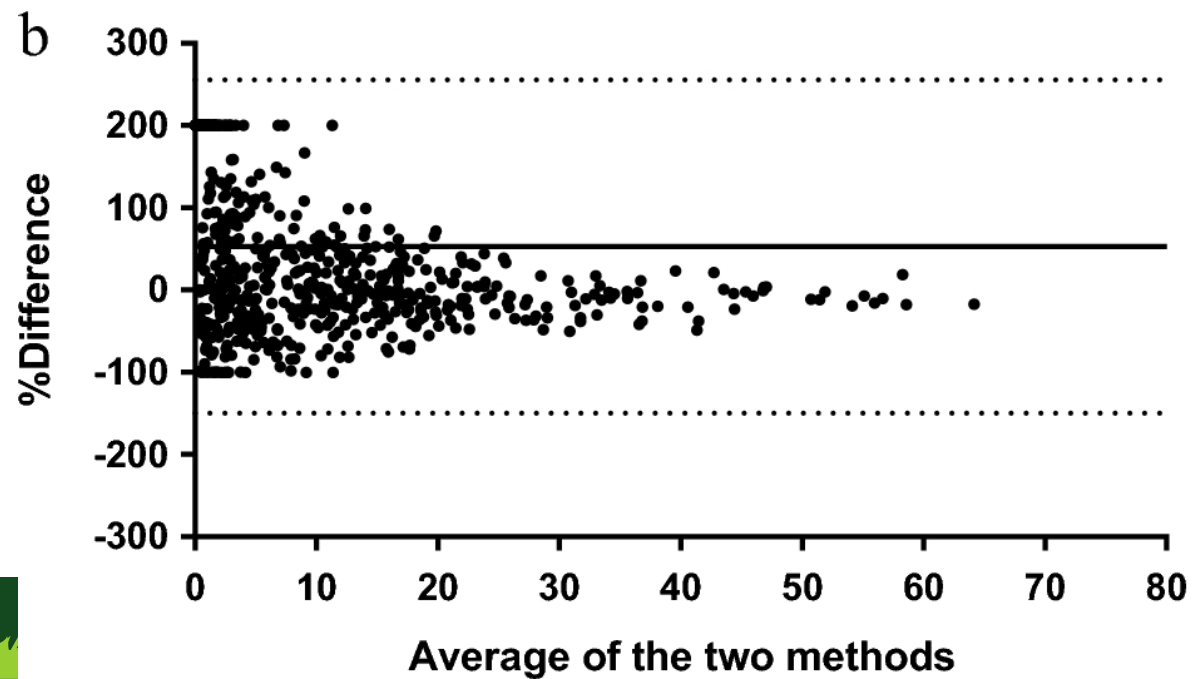
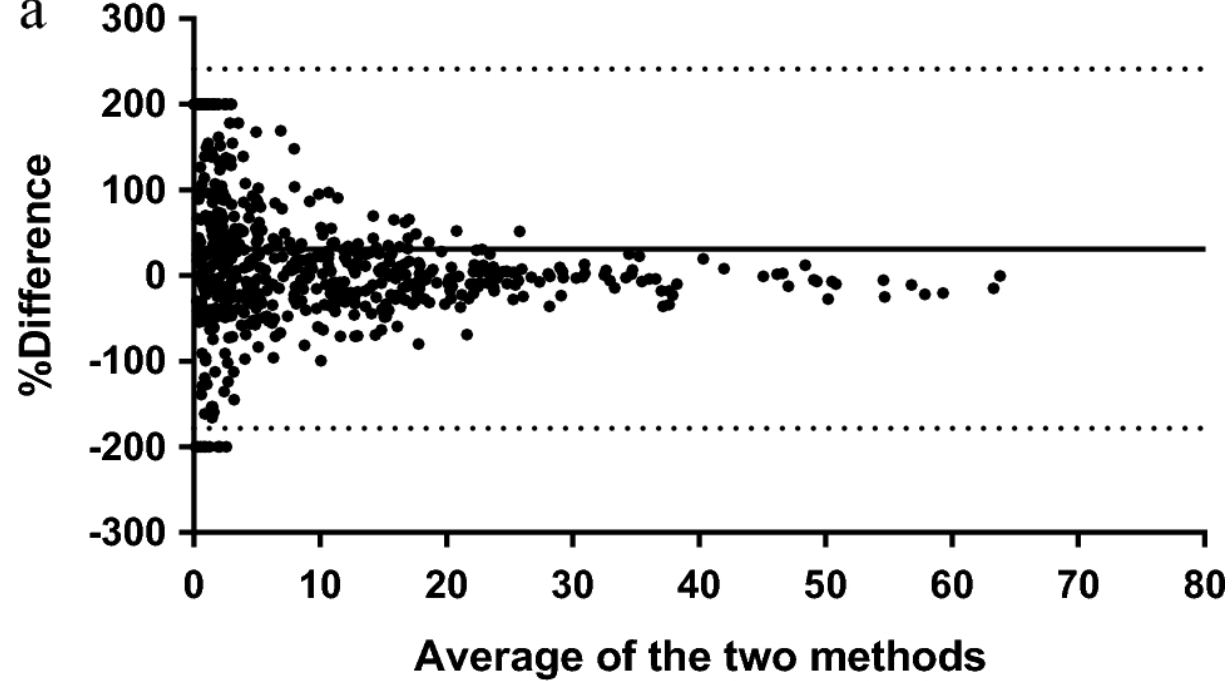
b

a

b

ab





Sampling intervals greater than 10 min reduce the accuracy of rare behaviors (e.g. Attacking).

30-min sampling interval was able to detect differences among genotypes in high-occurrence behaviors (e.g. locomotory activity).

From a practical viewpoint, when a broad characterization of chicken genotypes is required, the 30-min scan-sampling is a good compromise between resources and results obtainable.

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