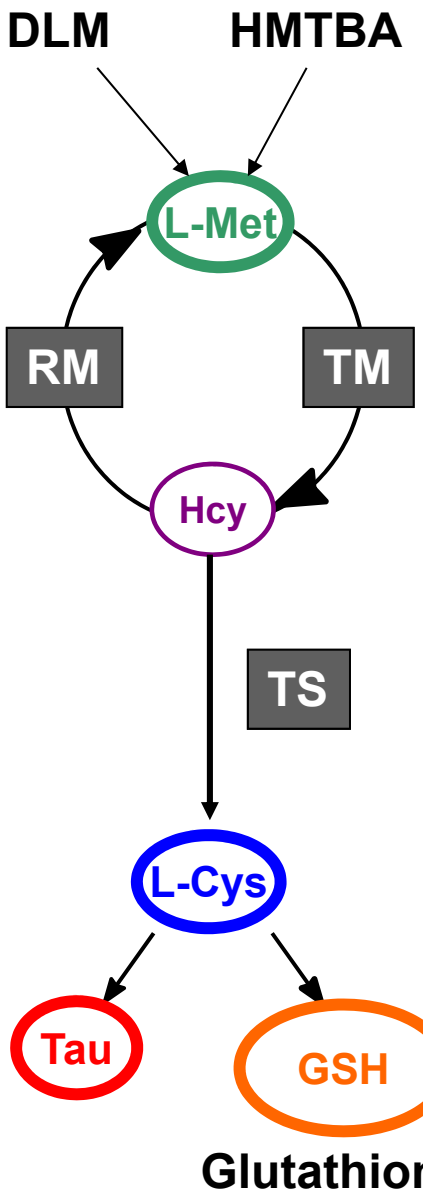
HMSeBA or Seleno-hydroxy-methionine: an efficient selenium source for pigs

M. Briens*, M. Jlali, F. Couloigner, P.A. Geraert and Y. Mercier

Adisseo France SAS ; *Strasbourg University, France

Selenium: key for the anti-oxidant value of sulphur amino acids

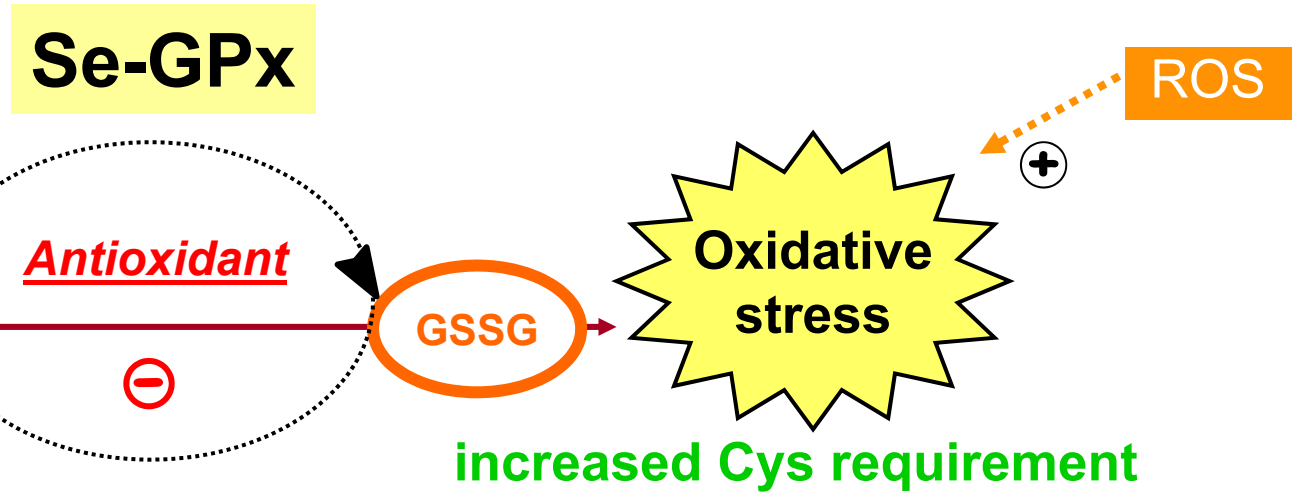
Selisseo



Sulfur amino acids, involved against oxidative stress

Oxidative stress induced more Cys consumed through GSH (Glu-Cys-Gly)

HMTBA induces more Cys produced, thus more anti-oxidant than Methionine



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Selenium: key for the anti-oxidant value of sulphur amino acids

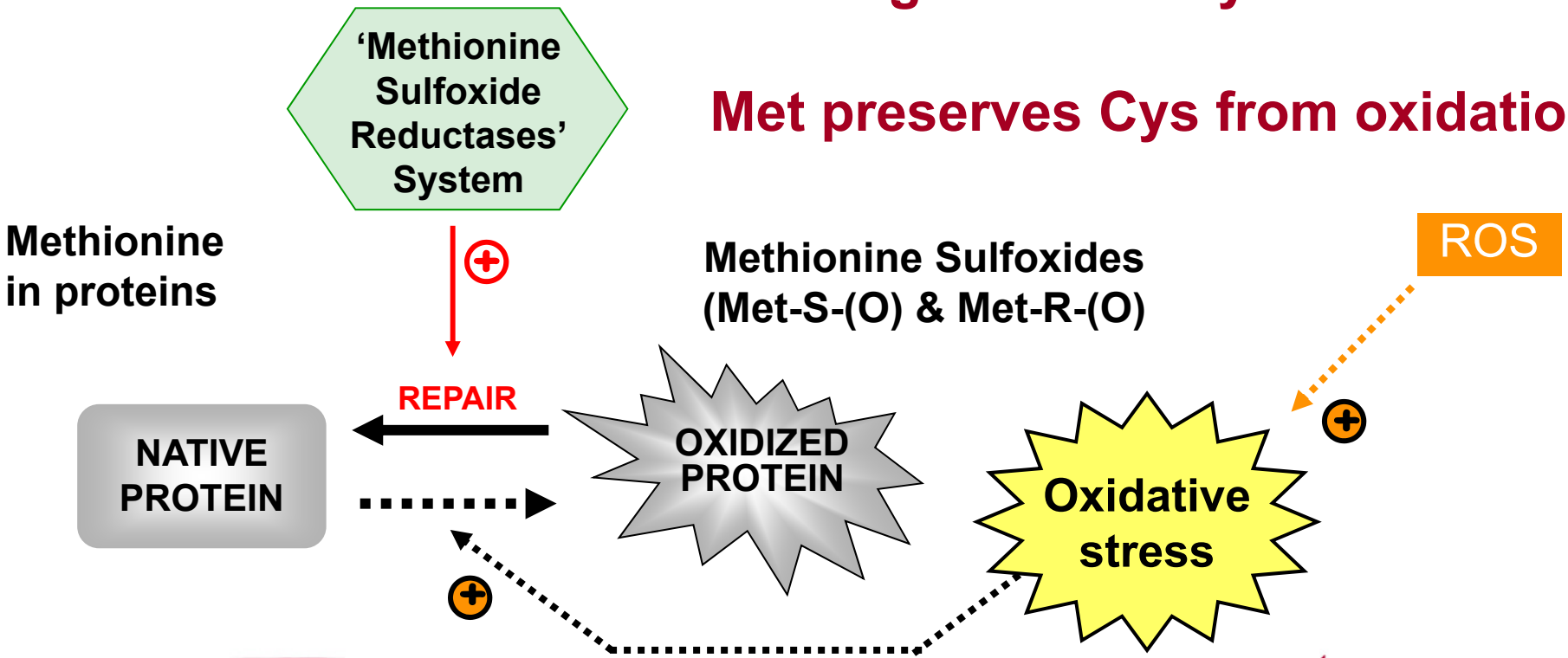
Selisseo

Msr system

MsrB: a selenoprotein

Met is not only oxidized, it has its own regeneration system

Met preserves Cys from oxidation



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Se: key for selenoproteins

Desiodinase isoforms : T4 to T3 conversion

Glutathione peroxidase with tissue specificity depending on isoform

MSR B : Reduction of methionine sulfoxide

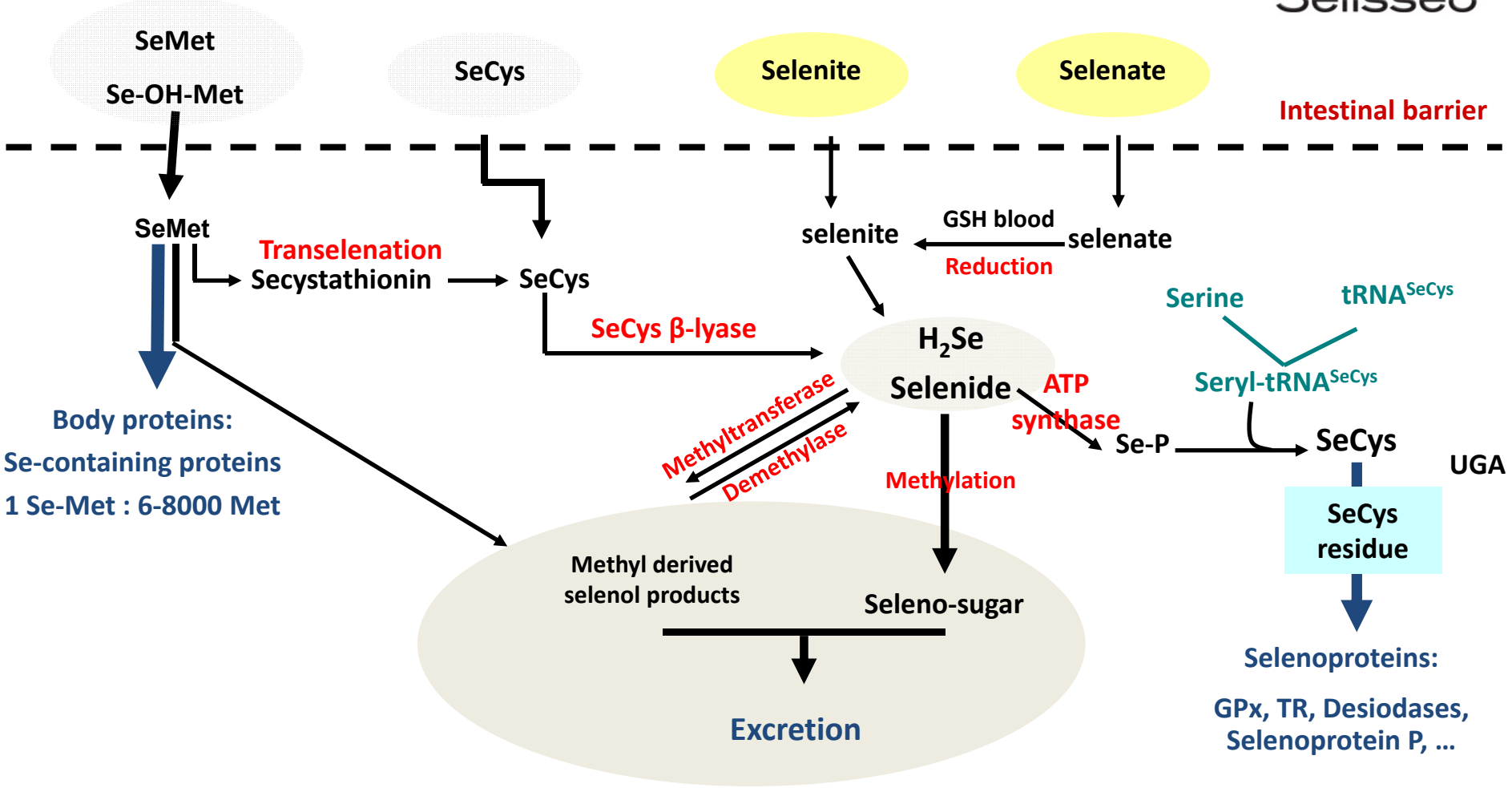
Selenium transport and possible peroxydase activity

Sel W muscle metabolism and function

Thioredoxine : antioxidant function

Seleno-protein characterized by a seleno-cysteine

Specific metabolism of selenium and seleno-amino acids AA

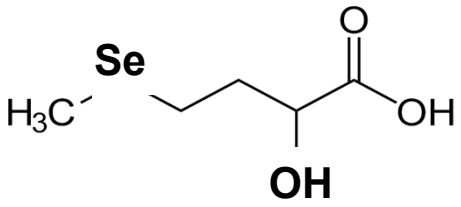


Se-P: selenophosphate

Adapted from Suzuki et *al*. 2005
and Thiry et *al.* 2012

Why Se-OH-Methionine ?

Seleno-Hydroxy-Methionine
(HMSeBA)



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*2-**H**ydroxy-4-**M**ethyl**Se**leno**B**utanoic **A**cid*

A source of Se-methionine

A source of Se-cysteine

Experimental design

- **7 treatments x 8 pens x 2 pigs/pen (112 pigs in total)**
- **Gilts of 26.73 ± 3.15 kg BW**
- **NC (no Se added), Sodium Selenite (SS), Seleno-yeast (SY), HMSeBA (SO)**

	NC	SS-0.1	SS-0.3	SY-0.1	SY-0.3	SO-0.1	SO-0.3
Se source		Sodium selenite	Sodium selenite	Seleno yeast	Seleno yeast	HMSeBA	HMSeBA
Se supplementation (ppm)	0	0.1	0.3	0.1	0.3	0.1	0.3
Measured Se (ppm)	0.11	0.20	0.38	0.22	0.42	0.21	0.41

- **Growth Performance after 32 days of supplementation**
- **At d 32, all pigs for blood, liver and muscle (*Psoas major*) sampling**
- **Total Se concentration in plasma, liver and muscle**

Methods

%	Diet
Barley	33.4
Wheat	20.0
Corn	15.0
Soybean meal (48% CP)	8.5
Wheat bran	8.0
Canola meal	6.2
Sunflower meal (36% CP)	2.8
Se free premix	0.55
NE (MJ/kg)	9.48
Protein (%)	15.5

Statistics

- ✓ **SAS 9.1.3**
- ✓ **Relative bioavailability by slope ratio method (PROC NLIN SAS)**

$$Se = a + a^{\circ} X^{\circ} + b_S \times (b_{TS} \times dose_{SO} + dose_{SY})$$

Total Se analysis

- ✓ **According to Mester et al., 2006**
- ✓ **Mineralisation with HN03 & H2O2**
- ✓ **ICP-MS**

Tissue speciation (Se-Met & Se-Cys)

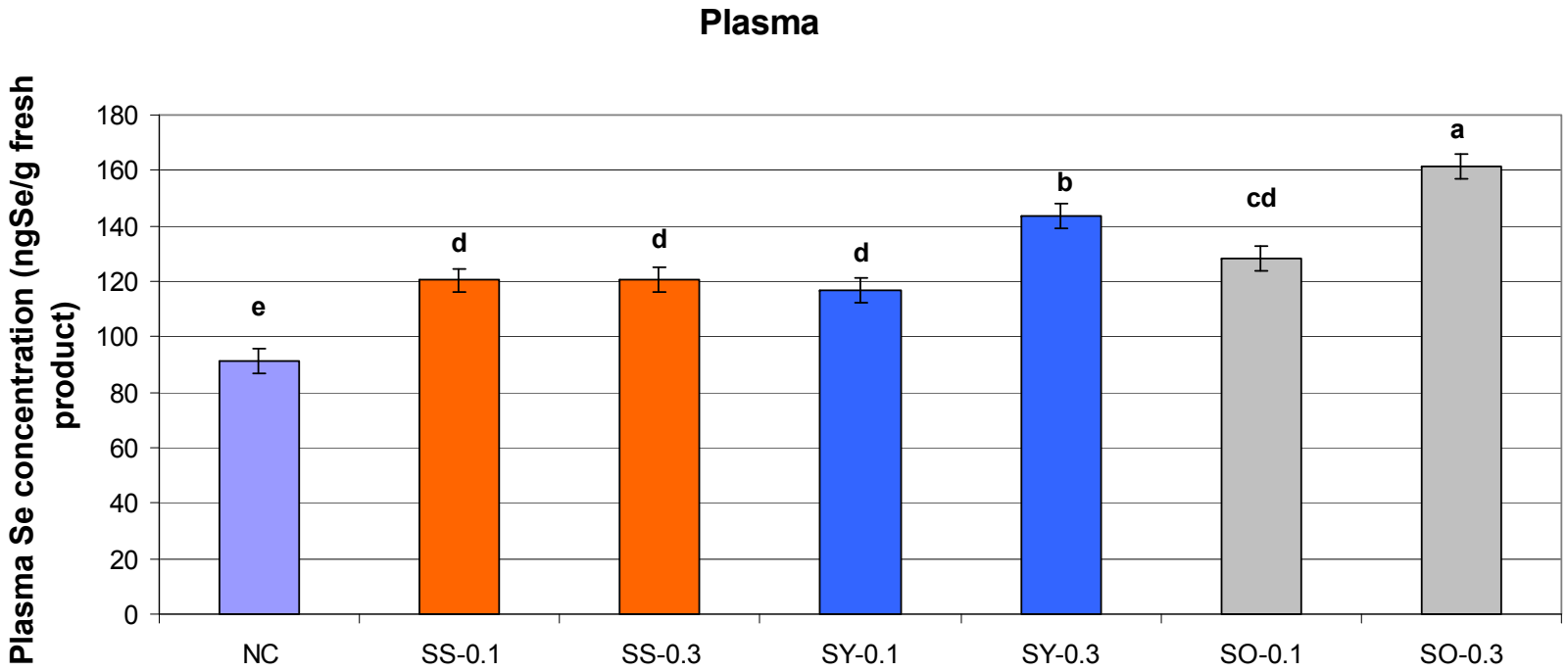
- ✓ **According to Bierla et al., 2008**
- ✓ **Se-Cys is reduced and alkylated to be stabilised**
- ✓ **Then proteolytic digestion to release free AA, purified by size-exclusion HPLC**
- ✓ **Quantification of Se-Met and Se-Cys by reversed phase HPLC-ICP-MS**
- ✓ **HMSeBA was also quantified (Vacchina et al., 2010)**

Growth performance

	Treatment								
	NC	SS-0.1	SS-0.3	SY-0.1	SY-0.3	SO-0.1	SO-0.3	SEM	P-value
BW (kg)									
Initial	26.79	26.91	26.84	27.00	26.34	26.76	26.48	0.34	0.81
Final	52.89	53.65	52.22	50.72	52.55	52.58	52.33	0.94	0.51
ADG (kg)	0.831	0.855	0.810	0.761	0.819	0.820	0.813	0.030	0.50
ADFI (kg)	1.834	1.874	1.792	1.734	1.801	1.804	1.788	0.040	0.44
FCR	2.21	2.19	2.21	2.28	2.19	2.20	2.20	0.01	0.78

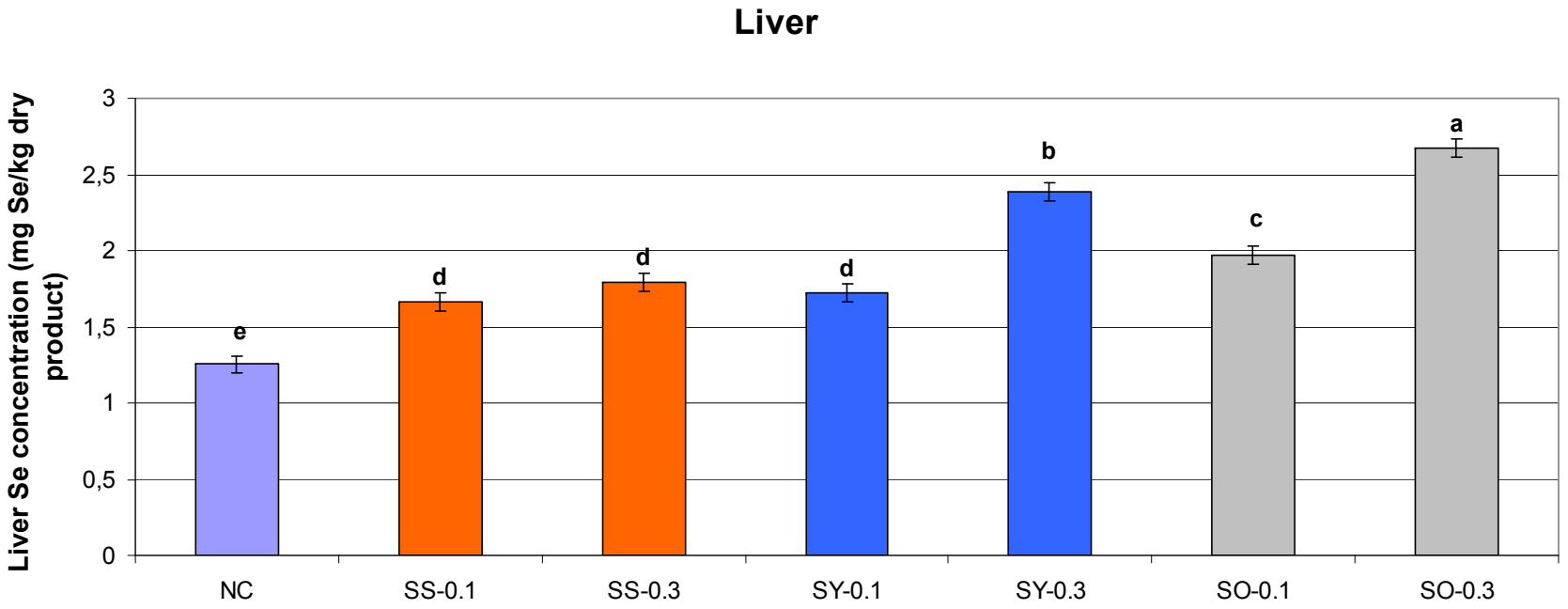
- Under experimental conditions, Se supplementation did not significantly change growth performance

Higher circulating Se with organic Se source



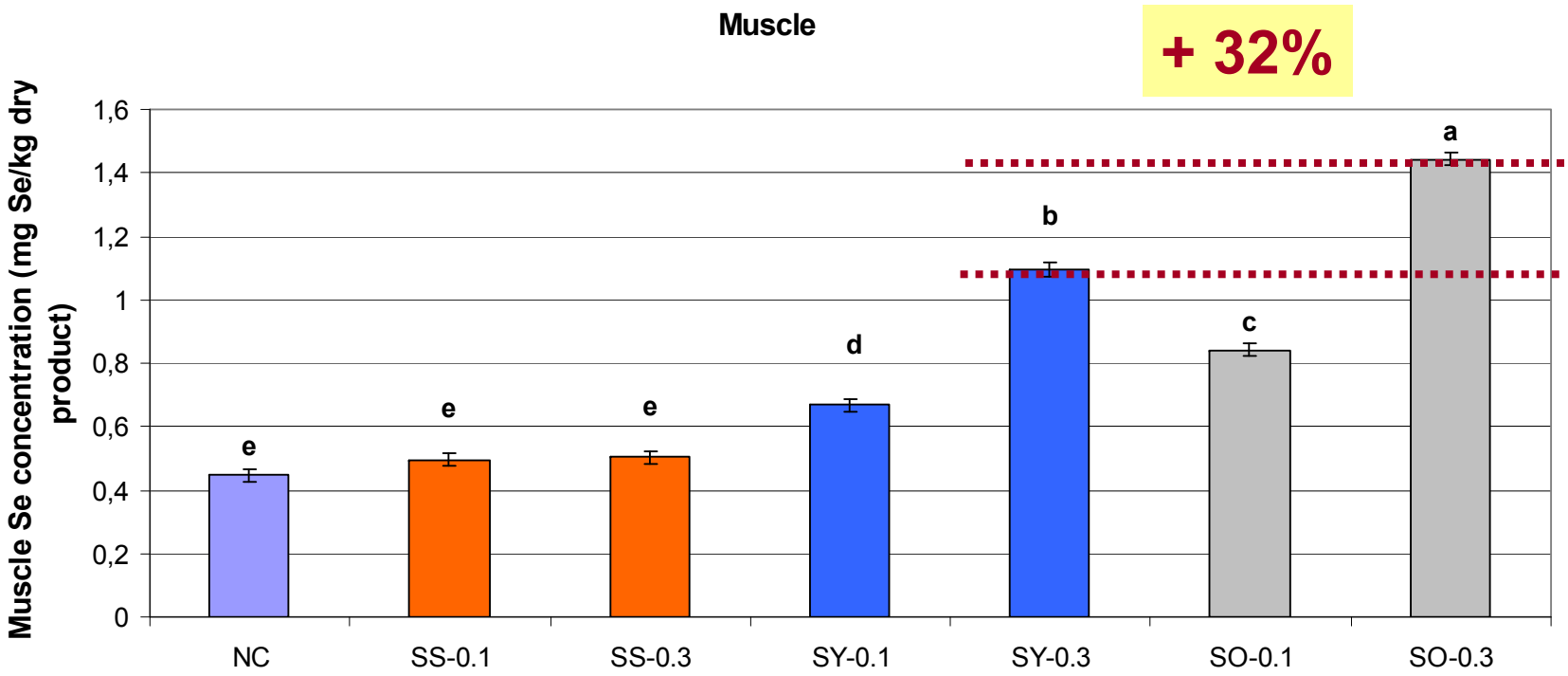
- Similar plasma Se for all diets at 0.1 mg Se/kg
- Increase dietary Se from 0.1 to 0.3 mg Se/kg increases plasma Se content only for organic Se sources (SY and SO)
- At 0.3 mg Se/kg SO had higher plasma Se content than SY

HMSeBA better Se source for improve liver Se content



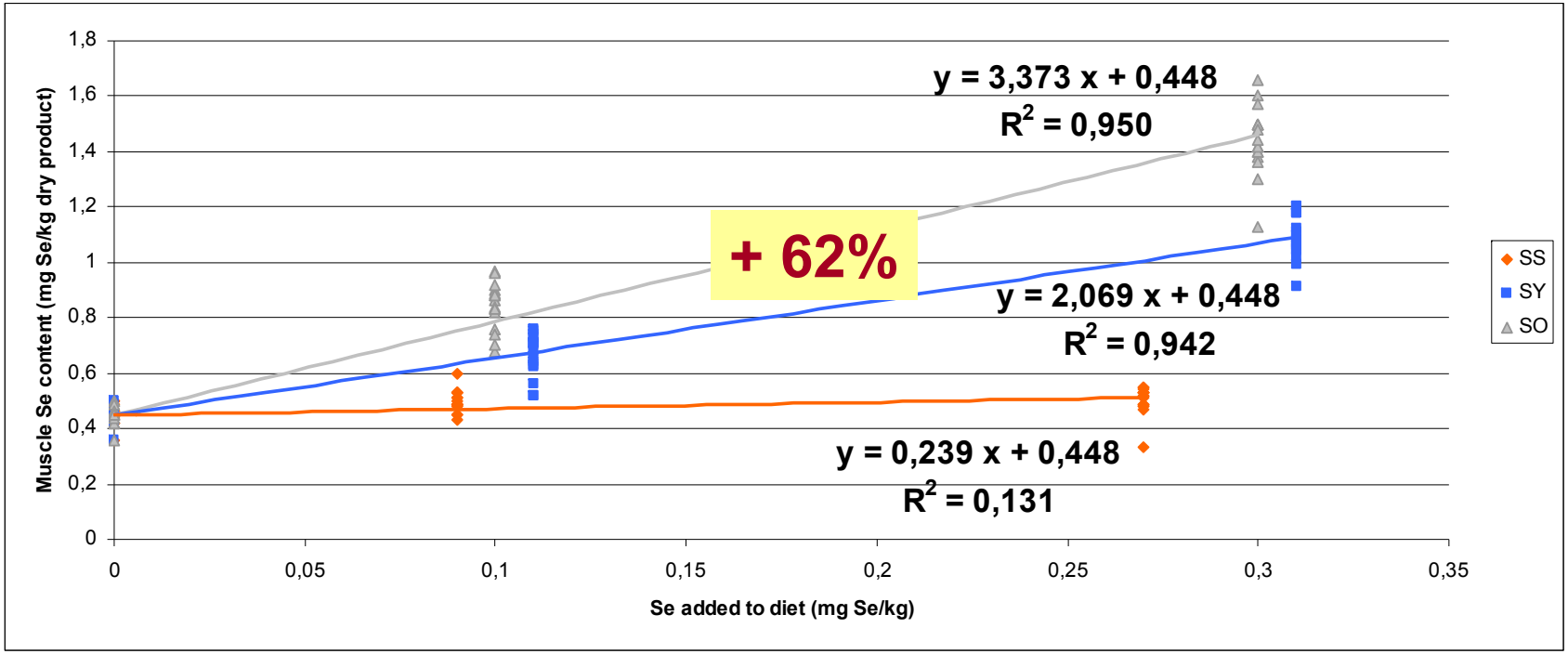
- Se supplementation increases liver Se content
- At 0.3 mg Se/kg organic Se source had higher liver Se content than inorganic
- At all level, SO allows higher liver Se content than SY

Pigs fed HMSeBA show higher muscle Se deposition



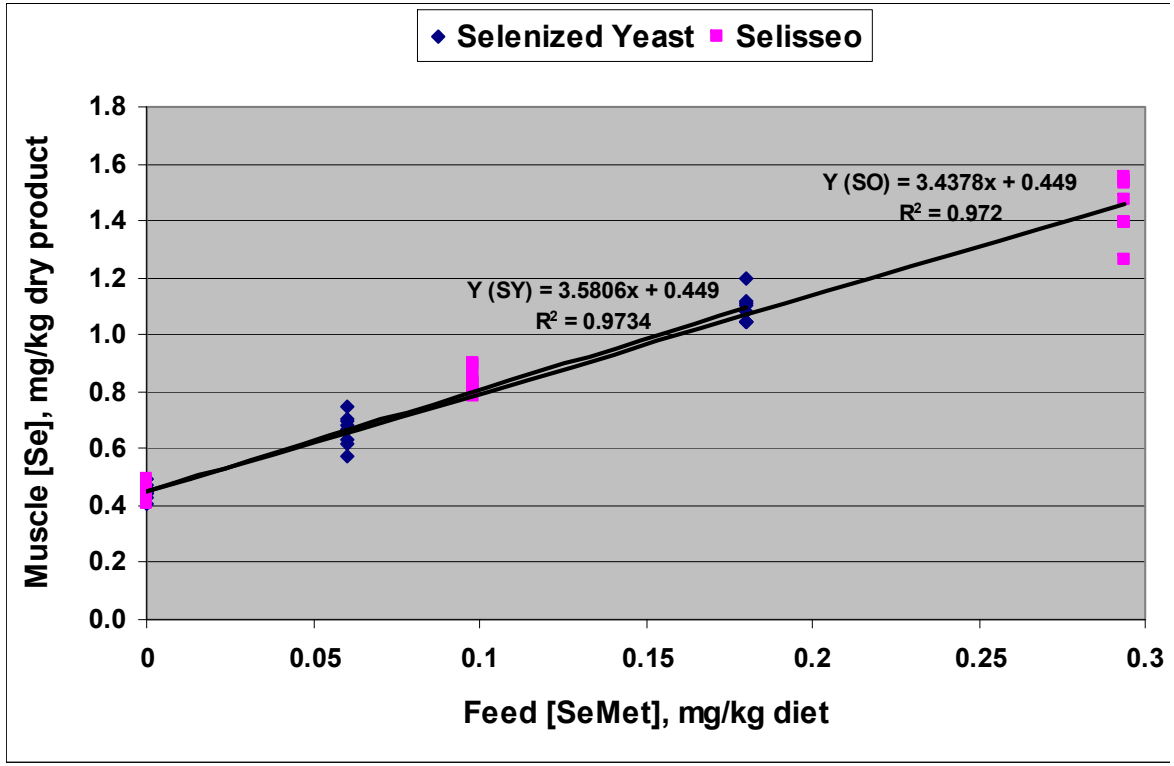
- Organic Se allows a better Se content compared to NC or inorganic Se
- Increase of dietary Se level for organic Se source increases muscle Se
- SO diets had higher muscle Se deposition than SY at all doses

HMSeBA is 100% efficient compared to seleno-yeast and selenite



- Inorganic Se is unable to increase muscle Se content
- In muscle, selenium from SO was 162% more deposited than SY

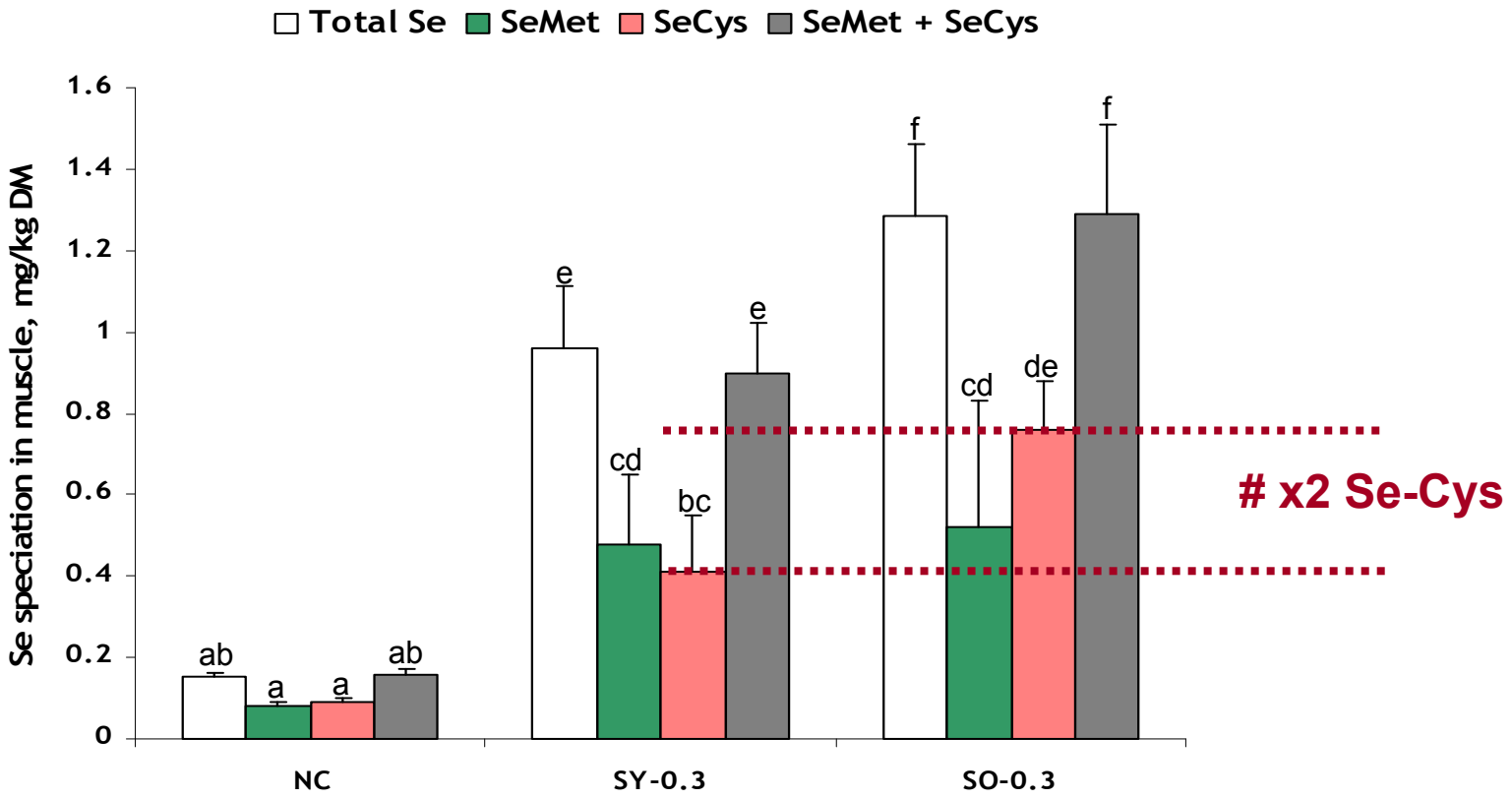
HMSeBA is 100% efficient compared to seleno-yeast



- Based on iso-Se-Met (measured values)
  - ✓ with 100% Se-OH-Met = 100% Se-Met
  - ✓ and 60% Se-Met in selenized yeast

Higher SeCys in tissues with HMSeBA

- Se species depending on the Se supply
  - ✓SeMet + SeCys allowed 100 % recovery of total Se in all treatments
  - ✓HMSeBA was not found in the muscle of broilers fed SO diets
  - ✓HMSeBA allowed a better content of SeCys than Seleno-Yeast



Broiler trial

Take Home Messages

- A new organic selenium source has been developed based on HMSeBA : 100% pure and reliable
- This HMSeBA appears 100% efficient compared to Se-yeasts where Se-Met is the only active part
- HMSeBA was more effective than SY to improve liver and muscle Se deposition in pigs
- HMSeBA is 100% transformed into seleno-amino acids and allowed higher Se-Cys (in Se-proteins) and Se (deposition) in tissues compared to Se-Yeasts, demonstrated in broilers
- Benefits of organic Se in animal nutrition will now be better demonstrated with this pure organic Se source