SelSaf

DUAL PROTECTION, DUAL BENEFIT

Selsaf®

Oxidative stress management, from feed to food

phileo-lesaffre.com

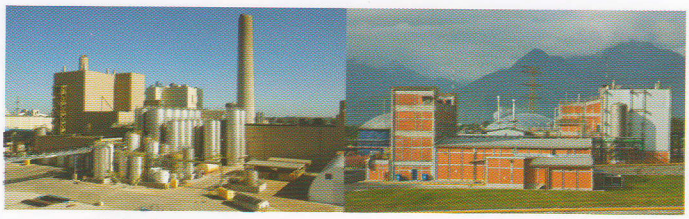
Phileo
LESAFFRE ANIMAL CARE

SelSaf

Natural source of organic selenium

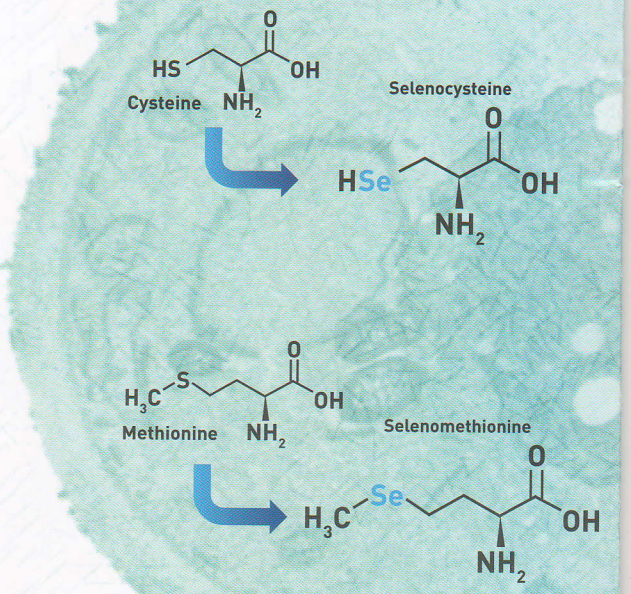
Selsaf®: dual source of SeMet and SeCys

Selsaf® is produced through natural fermentation by our proprietary *Saccharomyces cerevisiae* strain (CNCM I-3399) in our state-of-the-art production plants. The live yeast biotransforms sodium selenite into organic selenium by replacing the sulfur atom in methionine and cysteine with a selenium (Se) atom, producing molecules of selenocysteine (SeCys) and selenomethionine (SeMet), both major active seleno-compounds[1].



Cedar Rapids, USA

Toluca, Mexico



Selsaf®: consistent process and composition

Selsaf®'s standardized production process guarantees a high concentration of organic Se and a consistent active seleno-compound profile which helps protect the body against oxidative stress, both in the short-term (thanks to the SeCys) and in the long-term (due to the SeMet).

Kieliszek, M. et al. 2015. Accumulation and metabolism of selenium by yeast cells. Appl. Microbiology and Biotechnology. 99(13): 5373-5382.

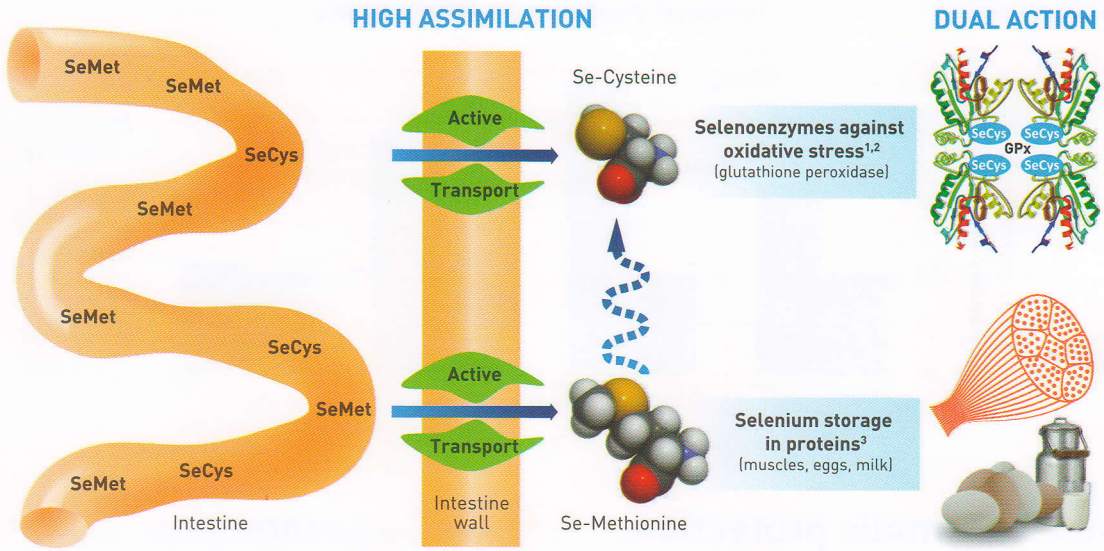
SelSaf

Active transport and high bioavailability

↑ Selenium assimilation in the intestine

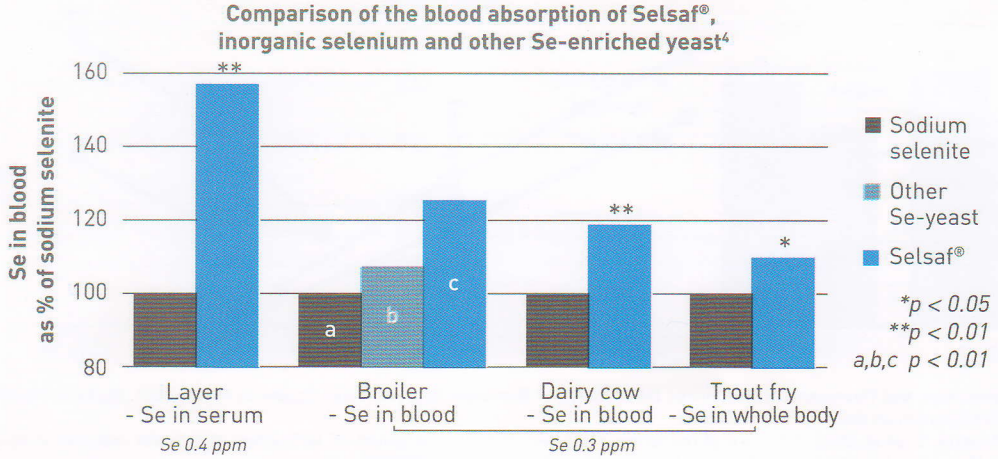
Once ingested, SeCys and SeMet are actively absorbed by transporter systems in the small intestine, which enable maximum assimilation and produce dual results in the animal:

- Natural resistance to oxidative stress via selenoenzymes such as glutathione peroxidase (GPx).
- Se enrichment in body tissues by deposition of SeMet.



↑ Selenium levels in the blood

Selsaf® is absorbed much more efficiently than sodium selenite, which is transported passively. Data from all animal species show that supplementation with Selsaf® results in better assimilation of Se into the blood than with sodium selenite and Se-enriched yeast (Se-yeast).



[1] Cillard, J. and Cillard, P. 2006. Mécanismes de la peroxydation lipidique et des anti-oxydations. Oilseeds & fats Crops and Lipids. 13(1).
[2] Estévez, M. 2015. Oxidative damage to poultry: from farm to fork. Poultry Science. 94(6): 1368-1378.
[3] Dlouha, G. et al. 2008. Effect of dietary selenium sources on growth performance, breast muscle selenium, glutathione peroxidase activity and oxidative stability in broilers. Czech J. Anim. Science. 53(6): 265-269.
[4] The EFSA Journal (2009) 992, 1-24; Journal of Animal and Feed Sciences. 2015. 24:93–99.

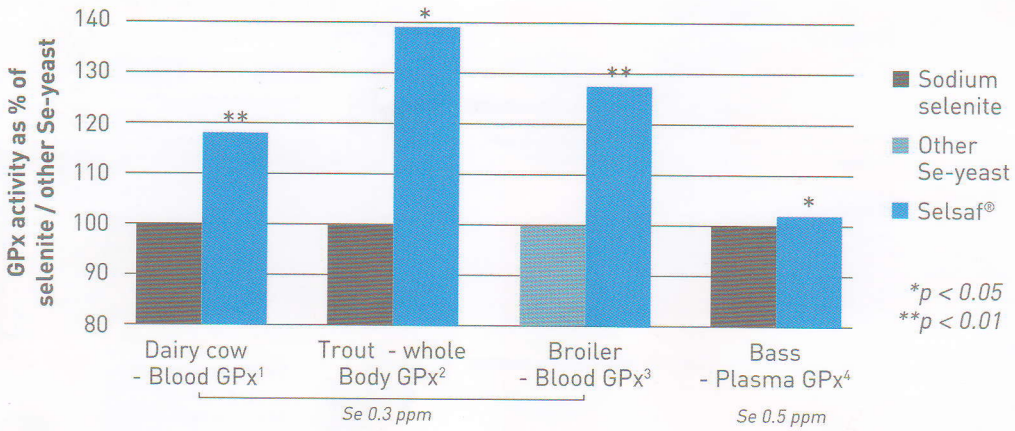
SelSaf DUAL PROTECTION

Natural resistance to oxidative stress

Enzymatic protection: ↑ GPx activity

By providing selenocysteine and other active seleno-compounds, Selsaf® helps protect against oxidative stress, particularly via glutathione peroxidase. This redox-regulating enzyme is essential for the neutralization of the reactive oxygen species responsible for oxidative stress.

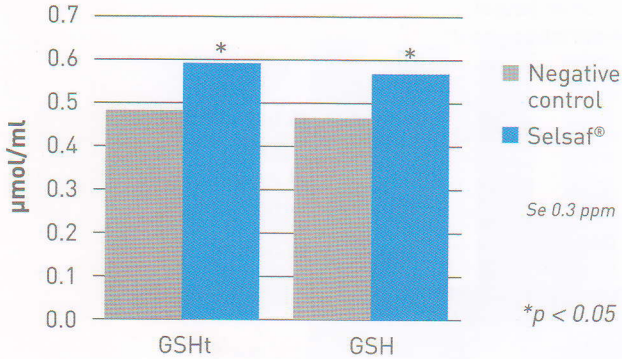
Increased glutathione peroxidase activity



Non-enzymatic protection: ↑ Glutathione concentration

Selsaf®increased concentrations of total glutathione (GSHt) and reduced glutathione (GSH) in juvenile trout, compared to a non-supplemented Control group[5].

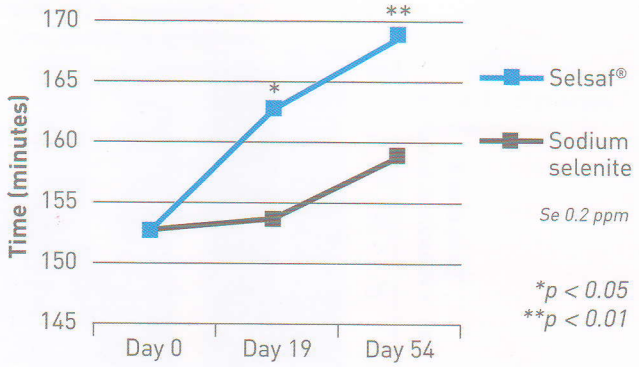
Increased GSHt and GSH plasma levels
Trout



Cell protection: ↑ Antiradical capacity

Erythrocytes are better protected against free radicals, as the time taken to haemolyze 50% of them increases significantly in beef cattle supplemented with Selsaf®, compared to sodium selenite[6].

Increased antiradical capacity of whole blood
Beef cattle



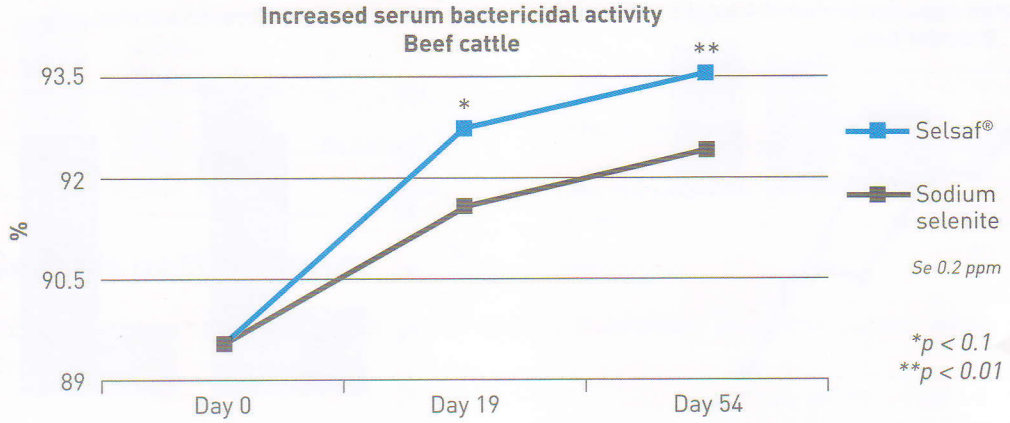
[1] Faculty of Veterinary and Pharmaceutical Sciences (VFU), Clinic of Ruminant Disease, Velké Opatovice Farm. 2007. Study on the efficacy and tolerance of Selsaf® supplementation on dairy cows. Data on file.
[2] Fontagné-Dicharry, S. et al. 2015. Influence of the forms and levels of dietary selenium on antioxidant status and oxidative stress-related parameters in rainbow trout *(Oncorhynchus mykiss)* fry. British J. Nutr. doi:10.1017/S0007114515001300.
[3] International Poultry Testing Station, Ustrasice, Czech Republic. 2016. The effect of Se-products on performance parameters in broiler chickens. Data on file.
[4] Chinese Academy of Agricultural Science, China. 2016. Tolerance of Various Selenium Sources in Diets of Largemouth Bass *(Micropterus salmoides)*. Data on file.
[5] National Institute for Agricultural Research (INRA). 2016. Impact d'une supplémentation de l'aliment en levures sur la croissance, la qualité de la chair et les défenses anti-oxydantes de truites arc-en-ciel juvéniles en conditions normales ou stressantes. Data on file.
[6] Department of Veterinary Science and Technologies for Food Safety (VSA), University of Milan. 2016. Use of organic selenium for cattle nutrition. Data on file.

SelSaf DUAL PROTECTION

Boosting natural defenses

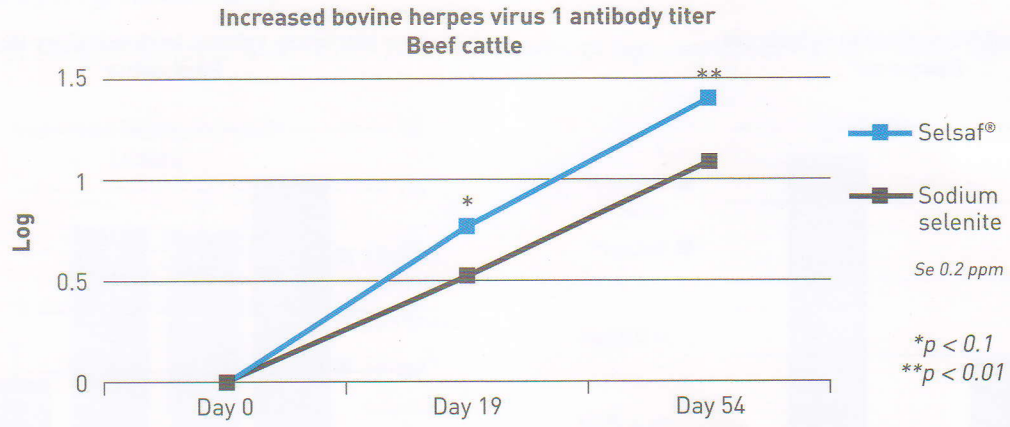
Innate immune response: ↑ Bactericidal activity

Serum bactericidal activity of under 90% increases sensitivity to pathological events. Serum bactericidal activity in beef cattle supplemented with Selsaf® recovered more strongly after transportation (day 0) than cattle given sodium selenite, indicating better resistance to pathogens[1].



Potentiating vaccine response: ↑ Antibody titers

Oxidative stress is often related to immunity. Beef cattle supplemented with Selsaf® developed a higher titer of neutralizing antibodies after vaccination with a bovine herpes virus 1 (BHV-1) vaccine administered on day 0, compared to sodium selenite[1].



[1] Department of Veterinary Science and Technologies for Food Safety (VSA), University of Milan. 2016. Use of organic selenium for cattle nutrition. Data on file.

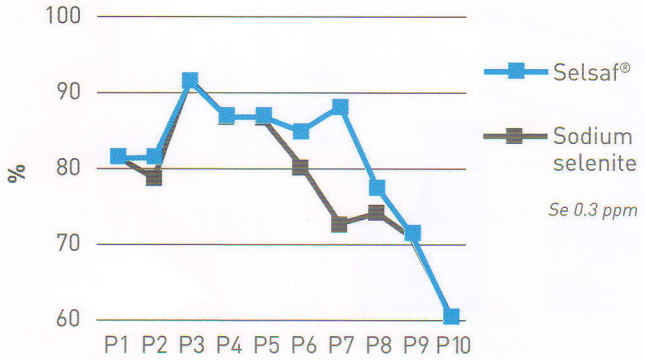
SelSaf BENEFITS TO FARMERS

Animal health

↑ Embryo viability

Embryo viability improved in the Selsaf® group, increasing by 12 hatched chicks per breeder hen over a period of 40 weeks (196.6 on average), compared to the Sodium selenite group (184.6).

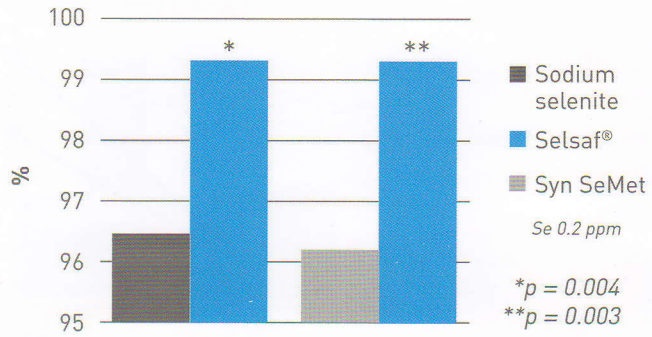
Hatched incubated eggs per period of 4 weeks
Breeder hens[1]



↑ Survival rate

Selsaf® supplementation (from 20 to 52 weeks of age) significantly improved the survival rate in laying hens, compared to sodium selenite and synthetic selenomethionine.

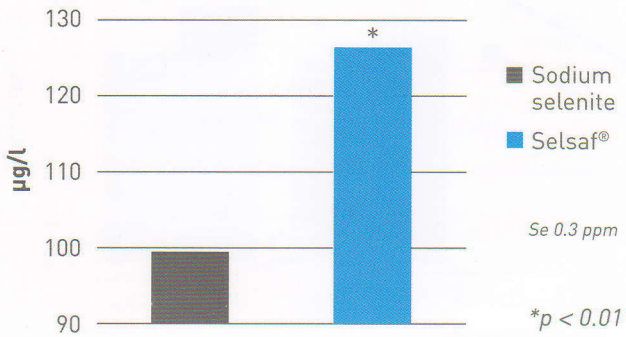
Improved survival rate
Layers[2]



↑ Se transfer to offspring

Selsaf® supplementation significantly increased incorporation of SeMet into dairy cow colostrum, used as an organic source of Se by the calf, improving their Se status and antioxidant defense.

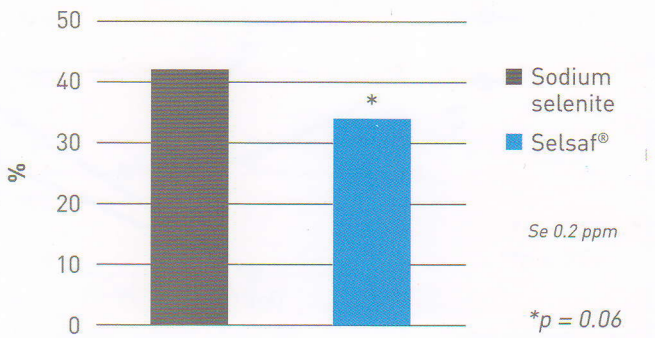
Increased Se content in colostrum
Dairy cow[3]



↓ Morbidity

Immune systems of beef cattle supplemented with Selsaf® recovered after transport, as evidenced by a reduced incidence of respiratory disease during the feedlot adaptation phase.

Morbidity related to respiratory disease
Beef cattle[4]



[1] D. Kumprechtová et al., International Poultry Testing Station, Ustrasice, Czech Republic. 2011. Effect of Selsaf® on performance and health of parent hens, and on the content of Se in eggs. Data on file.
[2] International Poultry Testing Station, Ustrasice, Czech Republic. 2015. Effects of dietary supplementation with selenium yeast as compared with other Se sources on egg quality and performance parameters and selenium status in laying hens. Data on file.
[3] Faculty of Veterinary and Pharmaceutical Sciences (VFU), Clinic of Ruminant Disease, Velké Opatovice Farm. 2007. Study on the efficacy and tolerance of Selsaf supplementation on dairy cows. Data on file.
[4] Department of Veterinary Science and Technologies for Food Safety (VSA), University of Milan. 2016. Use of organic selenium for cattle nutrition. Data on file.

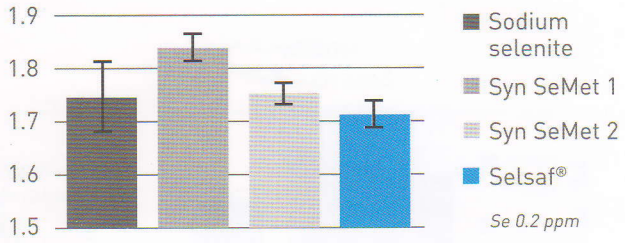
SelSaf BENEFITS TO FARMERS

Animal performance

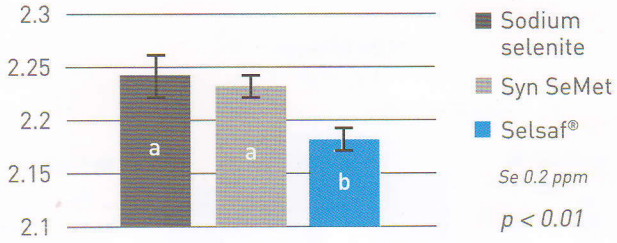
↑ Feed efficiency

Selsaf® supplementation improved feed conversion ratio (FCR) in broilers and layers compared to sodium selenite and synthetic SeMet.

Improved FCR Broiler[1]



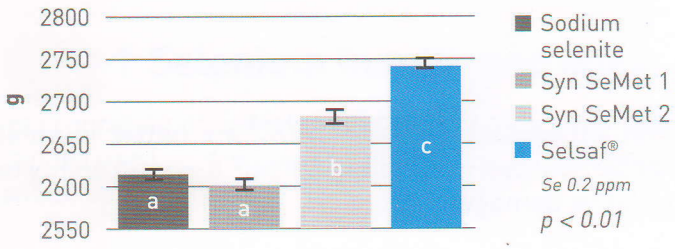
Improved FCR/egg Layers[2]



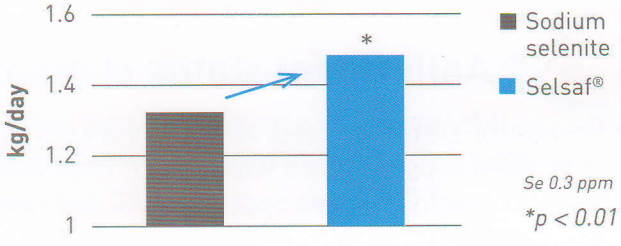
↑ Growth performance

Selsaf® supplementation improved growth performance in broilers and beef cattle, while still improving feed efficiency.

Increased body weight d42 Broiler[1]



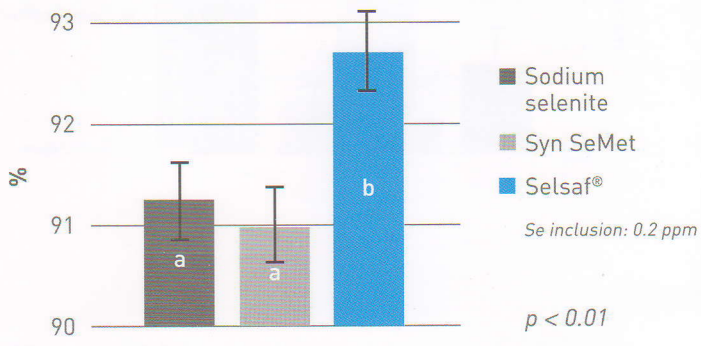
Increased average daily gain Beef cattle[3]



↑ Laying intensity

The addition of Selsaf® to layer diets from 20 to 52 weeks of age significantly increased laying intensity.

Improved laying intensity Layers[2]



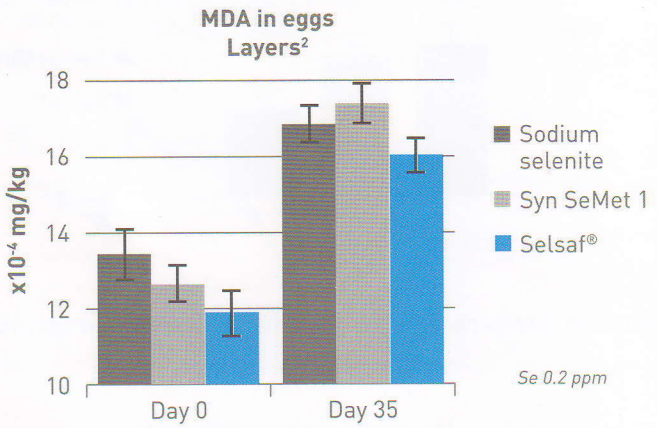
[1] International Poultry Testing Station, Ustrasice, Czech Republic. 2016. The effect of Se-products on performance parameters in broiler chickens. Data on file.
[2] International Poultry Testing Station, Ustrasice, Czech Republic. 2015. Effects of dietary supplementation with selenium yeast as compared with other Se sources on egg quality and performance parameters and selenium status in laying hens. Data on file.
[3] Department of Veterinary Science and Technologies for Food Safety (VSA), University of Milan. 2016. Use of organic selenium for cattle nutrition. Data on file.

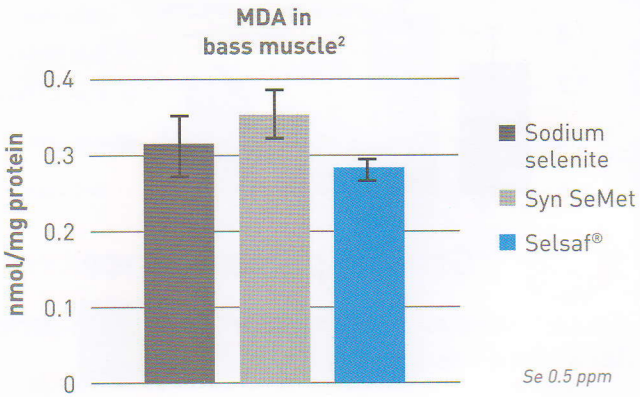
SelSaf BENEFITS TO CONSUMERS

Preventing food oxidation

↓ Lipid oxidation in eggs and fish

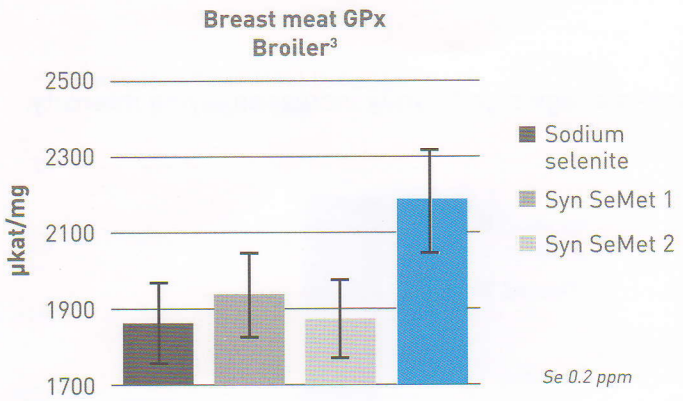
Animal products which are rich in unsaturated fatty acids are highly susceptible to oxidation, which is measured by the level of malondialdehyde (MDA), a secondary product of lipid oxidation. Selsaf® can reduce lipid oxidation in eggs immediately after lay and for 35 days in storage. Reduced MDA levels can also be seen in bass muscle.

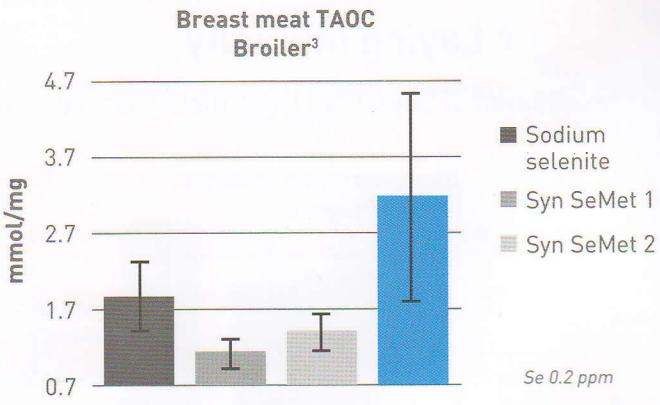




↑ Antioxidant status of meat

Antioxidative status (measured by GPx levels) and total antioxidant capacity (TAOC) are better in meat from broilers supplemented with Selsaf® than with other Se sources, illustrating Selsaf®'s overall ability to counteract reactive oxygen species (ROS) and resist oxidative damage.





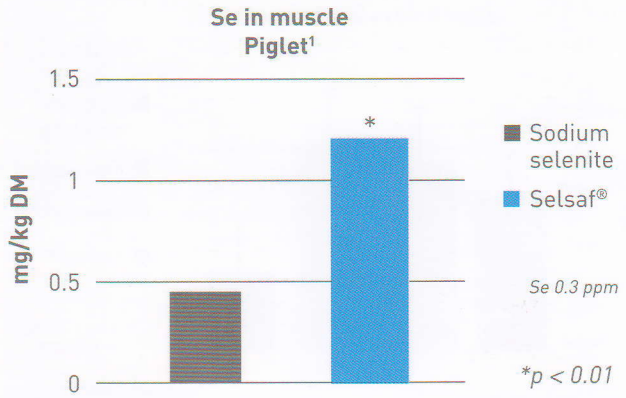
[1] International Poultry Testing Station, Ustrasice, Czech Republic. 2015. Effects of dietary supplementation with selenium yeast as compared with other Se sources on egg quality and performance parameters and selenium status in laying hens. Data on file.
[2] Chinese Academy of Agricultural Science, China. 2016. Tolerance of Various Selenium Sources in Diets of Largemouth Bass *(Micropterus salmoides)*. Data on file.
[3] International Poultry Testing Station, Ustrasice, Czech Republic. 2016. The effect of Se-products on performance parameters in broiler chickens. Data on file.

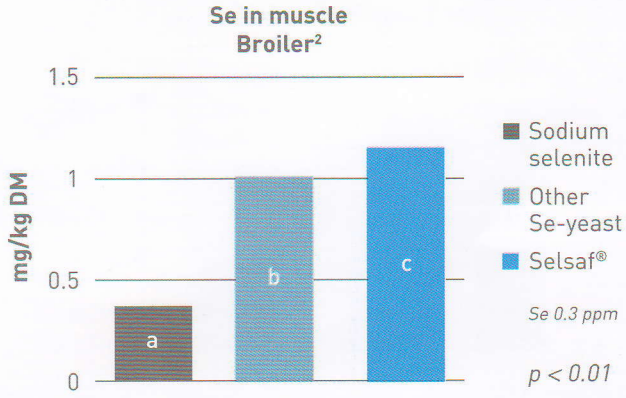
SelSaf BENEFITS TO CONSUMERS

Selenium-rich functional food

↑ Selenium in meat

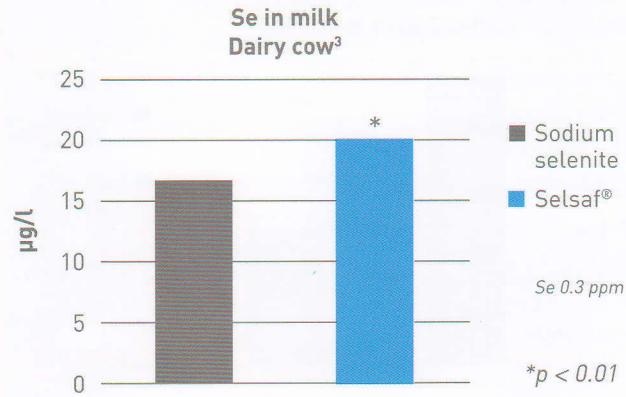
Several trials in animals have confirmed the non-specific incorporation of Selsaf®-derived SeMet into protein, resulting in a pool of Se (in the form of SeMet) in the muscles, which can be accessed during times of stress to improve the antioxidant defense. Supplementing piglets and layers with Selsaf® results in higher Se levels in meat than with an inorganic Se source or a Se-enriched yeast.

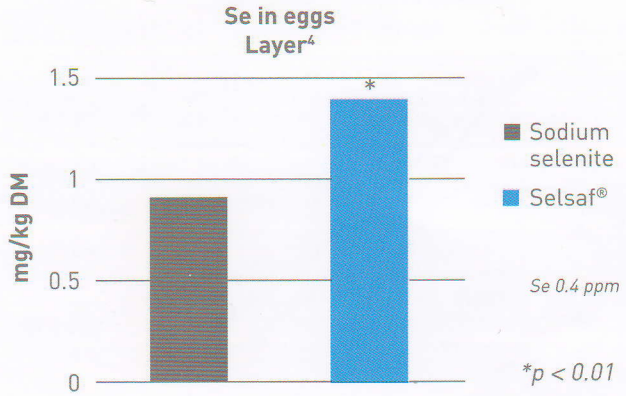




↑ Selenium in milk and eggs

Incorporation of SeMet into eggs and milk also indicates that Selsaf® gives rise to functional foods which can be used as a source of organic Se for both humans and animals, improving their Se status and the antioxidant defense.





[1] IRTA, Spain. 2007. Efficacy and tolerance of Selsaf® dietary supplementation and its effect on piglet performance after weaning. Data on file.
[2] International Poultry Testing Station, Ustrasice, Czech Republic. 2016. The effect of Se-products on performance parameters in broiler chickens. Data on file.
[3] Faculty of Veterinary and Pharmaceutical Sciences (VFU), Clinic of Ruminant Disease, Velké Opatovice Farm. 2007. Study on the efficacy and tolerance of Selsaf supplementation on dairy cows. Data on file.
[4] International Poultry Testing Station, Ustrasice, Czech Republic. 2015. Effects of dietary supplementation with selenium yeast as compared with other Se sources on egg quality and performance parameters and selenium status in laying hens. Data on file.

SelSaf

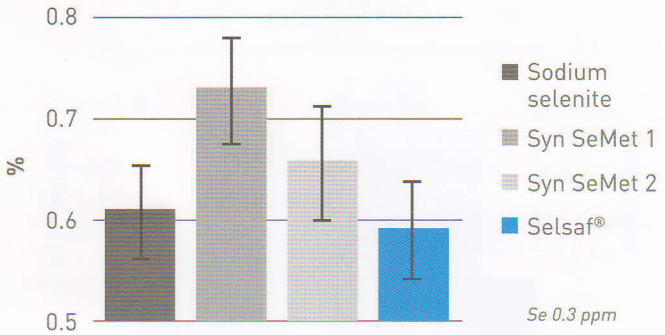
BENEFITS TO CONSUMERS

Meat quality and storage

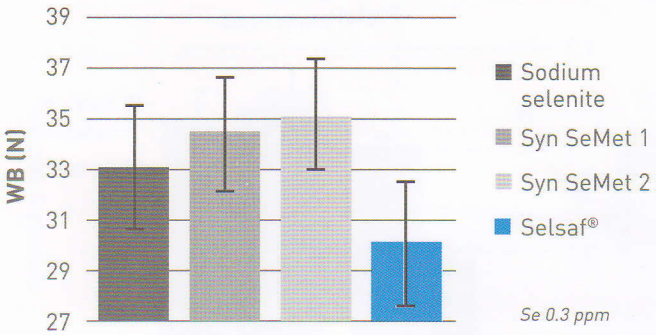
↑ Chicken meat: juiciness and tenderness

Water-holding capacity and meat tenderness are measured by drip loss and shear force respectively. **Selsaf®** supplementation reduced drip loss and shear force after 5 days in storage, resulting in more juicy and tender broiler meat compared to other Se sources.

Reduced drip loss in broiler meat after 5 days in storage[1]



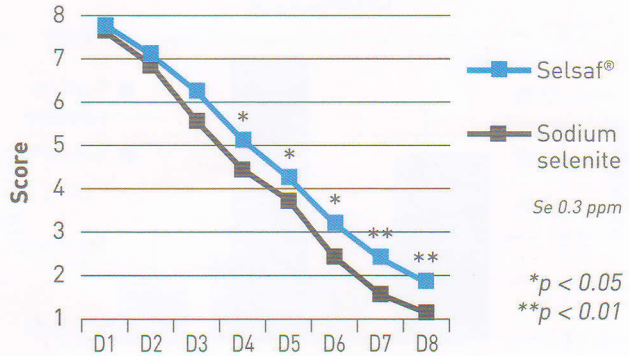
Reduced shear force in raw broiler meat after 5 days in storage[1]



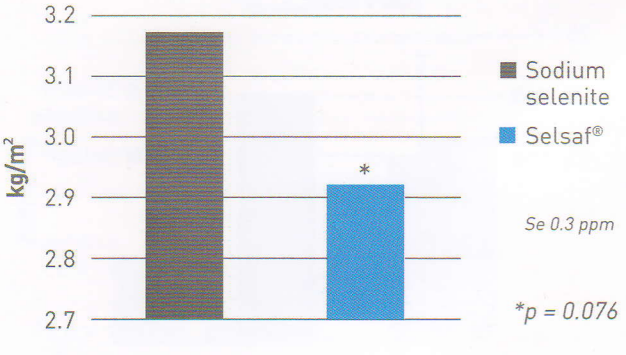
↑ Beef meat: attractiveness and tenderness

Selsaf® supplementation significantly improved overall beef meat appearance, based on color, odor and surface wetness, from the 4th day in storage compared to sodium selenite. The effect of Selsaf® on meat tenderness was confirmed by a reduced shear force in cooked meat after 2 days in storage. Improved meat quality and shelf life increases customer satisfaction and loyalty.

Improved overall appearance of beef meat[2]



Reduced shear force in cooked beef after 2 days in storage[2]



[1] International Poultry Testing Station, Ustrasice, Czech Republic. 2016. The effect of Se-products on performance parameters in broiler chickens. Data on file.
[2] Sgoifio Rossi, C.A. et al. 2015. The effects of different selenium sources during the finishing phase on beef quality. Journal of Animal and Feed Sciences. 24: 93-99.

SelSaf

Dual protection for dual benefits

Selsaf® benefits to Farmers: animal health

Breeder hens	**Hatchability**	**+ 6.5%** *vs.* sodium selenite
Laying hens	**Survival**	**+ 2.9 pt**** vs. sodium selenite **+ 3.1 pt**** vs. syn SeMet
Dairy cows	**Se transfer via colostrum**	**+ 27%**** *vs.* sodium selenite
Beef cattle	**Morbidity**	**- 6.9 pt**^{t}** *vs.* sodium selenite

Selsaf® benefits to Farmers: animal performance

Laying hens	**Laying intensity**	**+ 1.5 %**** *vs.* sodium selenite **+ 1.7%**** *vs.* syn SeMet
	FCR/egg	**- 2.6%**** *vs.* sodium selenite **- 2.2%**** *vs.* syn SeMet
Broilers	**Growth performance**	**+ 5%**** body weight *vs.* sodium selenite up to **+ 5.5%**** syn SeMet
	FCR	**- 1.9%** *vs.* sodium selenite up to **- 6.9%** syn SeMet
Beef cattle	**Average daily gain**	**+ 12%**** *vs.* sodium selenite

Selsaf® benefits to Consumers: food quality and shelf life

Eggs	**Lipid oxidation (↓ MDA)**	**- 5%** *vs.* sodium selenite **- 7.8%** *vs.* syn SeMet
Broiler meat	**Antioxidant status in breast meat (↓TAOC)**	**+ 71%** *vs.* sodium selenite up to **+ 183%** syn SeMet
Fish (bass)	**Lipid oxidation (↓ MDA)**	**- 20%** *vs.* sodium selenite

Selsaf® benefits to Consumers: nutrition and food pleasure

Eggs	**Selenium enrichment**	**+ 56%**** *vs.* sodium selenite
Broiler meat	**Selenium enrichment**	**x 3.2**** *vs.* sodium selenite **+ 14%**** *vs.* other Se-yeast
Pork	**Selenium enrichment**	**x 2.5**** vs. sodium selenite
Fish (trout)	**Selenium enrichment**	**+ 10%*** *vs.* sodium selenite
Milk (dairy cow)	**Selenium enrichment**	**+ 23%**** *vs.* sodium selenite
Broiler meat	**Juiciness (↓ drip loss)**	**- 32%** *vs.* sodium selenite
	Tenderness (↓ shear force)	up to **- 14.5%** vs. syn SeMet
Beef	**Tenderness (↓ shear force)**	**- 7.8%**^{t} *vs.* sodium selenite

MDA: malondialdehyde *TAOC: total antioxidant capacity*

$^{*}p < 0.05$ *$^{**}p < 0.01$* *$t\ p < 0.1$*

SelSaf

DUAL PROTECTION, DUAL BENEFIT

- ↑ **Antioxidant and natural defenses**
- ↑ **Animal health and performance**
- ↑ **Food quality and shelf life**

Species	Selsaf® 2200 (± 200) ppm of Se
Laying hens	90 g/t of feed
Broilers	90 g/t of feed
Dairy cows	90 g/t of feed
Beef cattle	90 g/t of feed
Swine	90 g/t of feed
Aquaculture	90 g/t of feed

Regulations vary by region and country. Consult local regulations for specific applications.

For further information, please contact your local representative.

- ✔ Packaging
  25 kg and 700 kg bags
- ✔ Shelf life: 3 years

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LESAFFRE ANIMAL CARE

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