



Comparison of using organic and inorganic Se  
supplements for producing Se enriched milk and  
cheese in dairy goats  
(S.06, #6, p. 39)



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# Se requirements and allowances in small ruminants:



Thresholds for Se in sheep & goat:

- Deficit **< 0.1 mg/kg DM** (INRA, 1988)
- Recommended  $\geq 0.1$  mg/kg DM (INRA, 1988)
- Toxicity  $\geq 0.3$  mg/kg DM (NRC, 1981)
- No differences between sheep and goat (?)
- EU authorized limit **< 0.5 mg/kg feed**  
(Na selenite or selenate)



# Inorganic vs. organic Se in dairy goats:

## 1.1. Materials & methods



- **32 Murciano-Granadina goats** ( $40.6 \pm 1.4$  kg BW) at early lactation (wk 3)
- Fed ad libitum (135% previous day) a **forage mixture** (1.03 UEL, 12.8% CP) poor in Se (**0.09 mg/kg**)
- Concentrate at flat rate ( $2 \times 0.4$  kg/d) to which the Se supplement was added
- Average diet (/kg DM): 0.84 UFL, 80 g PDIE, 74 g PDIN
- **2 sources** of Se:
  - Inorganic: **Na selenite (S, 46% Se)**
  - Organic: **Sel-Plex (SP, Selenized *Saccharomyces cerevisiae* CNCM I-3060; 0.21% Se)**

# Inorganic vs. organic Se in dairy goats:

## 1.2. Materials & methods



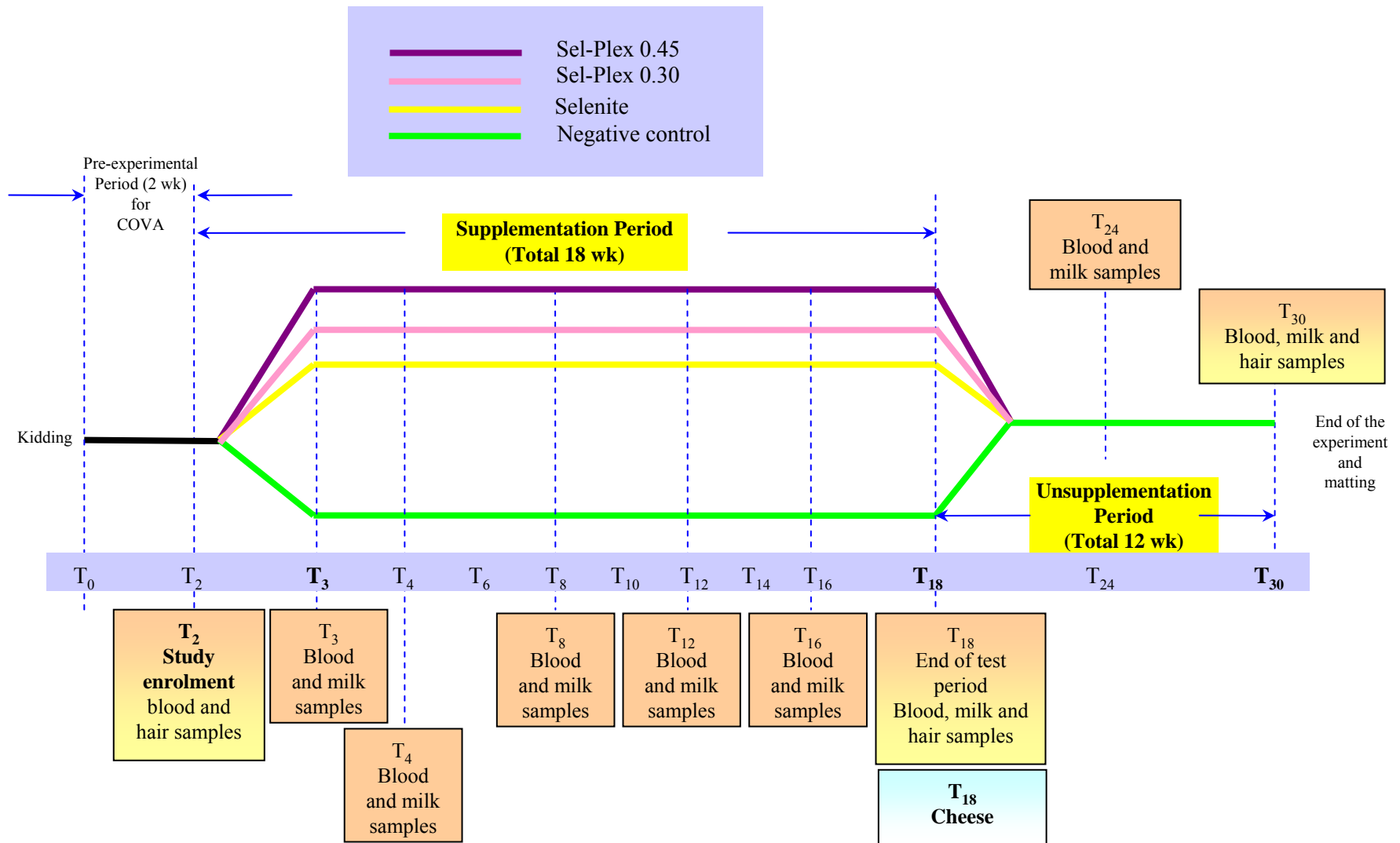
- **4 dietary treatments (concentrates):**
  - **Control negative** (0.04 mg/kg)
  - **S-0.30** (0.38 mg/kg)
  - **SP-0.30** (0.38 mg/kg)
  - **SP-0.45** (0.49 mg/kg)
- **3 experimental periods (210 d):**
  - **P1** (covariate) wk 4-5
  - **P2** (supplementation) wk 6-21
  - **P3** (washing-out) wk 22-33





# Inorganic vs. organic Se in dairy goats:

## 1.3. Experimental plan



# Inorganic vs. organic Se in dairy goats:

## 2.1. Results: Intake & lactational performance



Item	Treatment				±SE	P =
	Control	S-0.30	SP-0.30	SP-0.45		
DMI, kg/d	2.06	2.06	2.03	2.05	0.01	0.978
FCM 3.5% fat, L/d	1.85	1.58	1.95	1.66	0.13	0.176
BW, kg	39.4	39.3	37.7	39.0	1.4	0.748
BCS	2.6	2.6	2.6	2.7	0.1	0.908
Milk composition, %						
Total solids	13.2	13.2	13.4	13.2	0.3	0.975
Fat	4.68	4.59	4.71	4.87	0.19	0.730
Protein	3.73	3.80	3.83	3.67	0.15	0.860
True protein	3.35	3.40	3.38	3.31	0.14	0.968
CN	2.88	2.87	2.86	2.87	0.12	0.999
Casein-N/Total-N, %	77	76	75	78	1	0.250

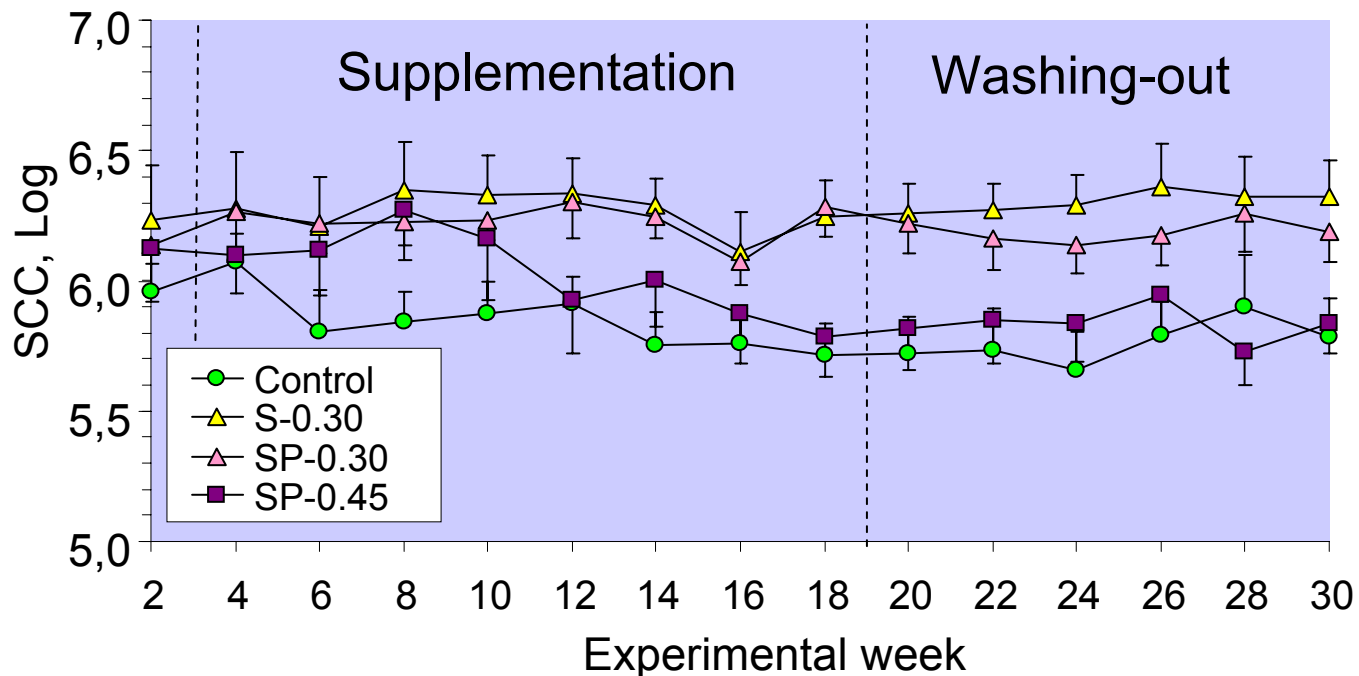
Voluntary intake ~ 5% BW!

# Inorganic vs. organic Se in dairy goats:

## 2.2. Results: Udder health

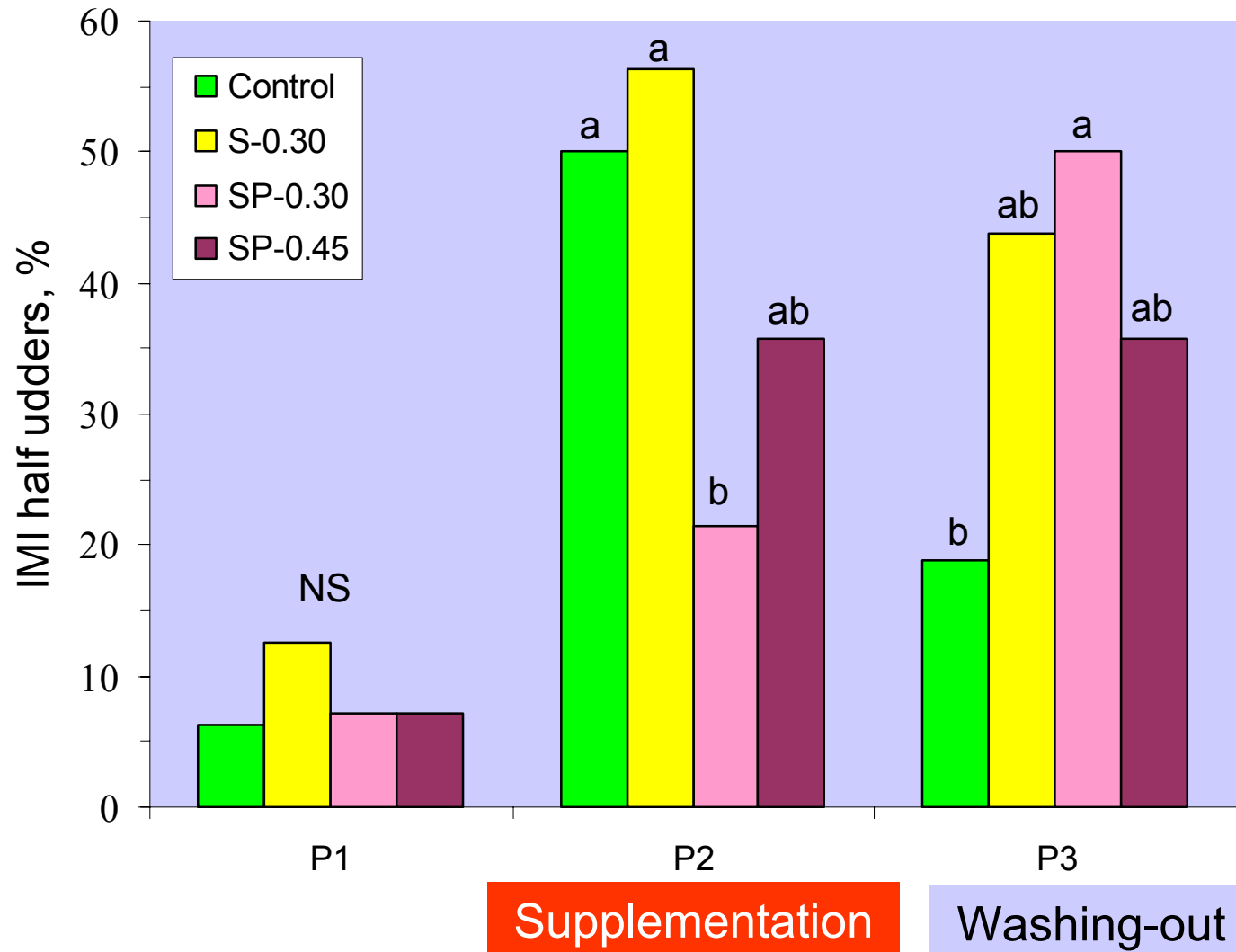


Item	Treatment				±SE	P =
	Control	S-0.30	SP-0.30	SP-0.45		
Milk pH	6.76	6.72	6.72	6.72	0.02	0.338
Log <sub>10</sub> SCC	5.88 <sup>b</sup>	6.18 <sup>a</sup>	6.16 <sup>a</sup>	6.09 <sup>ab</sup>	0.10	0.067
½ udders with IMI	8	9	3	5	2	—
IMI incidence, %	50.0	56.0	21.0	36.0	0.09	—



# Inorganic vs. organic Se in dairy goats:

## 2.3. Results: Prevalence of IMI ( $\geq 5$ cfu/mL)





# Inorganic vs. organic Se in dairy goats:

## 2.4. Results: Blood indicators



Item	Treatment				± SE	P =
	Control	S-0.30	SP-0.30	SP-0.45		
Enzymes, U/L:						
ALA transaminase	18.7 <sup>c</sup>	21.7 <sup>ab</sup>	23.3 <sup>a</sup>	19.1 <sup>bc</sup>	1.1	0.018
Alkaline phosphatase	97.8	88.5	74.1	77.1	7.6	0.116
ASP aminotransferase	88	91	98	109	10	0.474
CPK	134	118	116	100	11	0.169
Gammaglutamyl transpeptidase	63.8	57.7	75.9	70.9	5.4	0.107
GLU dehydrogenase	12.4	11.2	12.7	10.2	1.1	0.353
GSH-Px						
Whole blood	8.6 <sup>c</sup>	20.3 <sup>b</sup>	17.9 <sup>b</sup>	28.3 <sup>a</sup>	1.6	0.001
Serum	534 <sup>c</sup>	966 <sup>b</sup>	1,023 <sup>ab</sup>	1,204 <sup>a</sup>	69	0.001
LAC dehydrogenase	460	493	505	528	31	0.416
Thyroid hormones, ng/mL:						
T3	0.82	0.42	0.41	0.85	0.18	0.170
T4	122	119	106	123	9	0.530
T3/T4, ×100	0.67	0.35	0.39	0.69	—	—

ALA = Alanine  
 ASP = Aspartate  
 CPK = Creatine phosphokinase  
 GLU = Glutamate

GSH-Px = Glutathione peroxidase  
 LAC = Lactate  
 T3 = Tri-iodothyronine  
 T4 = Thyroxine

# Inorganic vs. organic Se in dairy goats:

## 2.5. Results: Se partitioning in body compartments

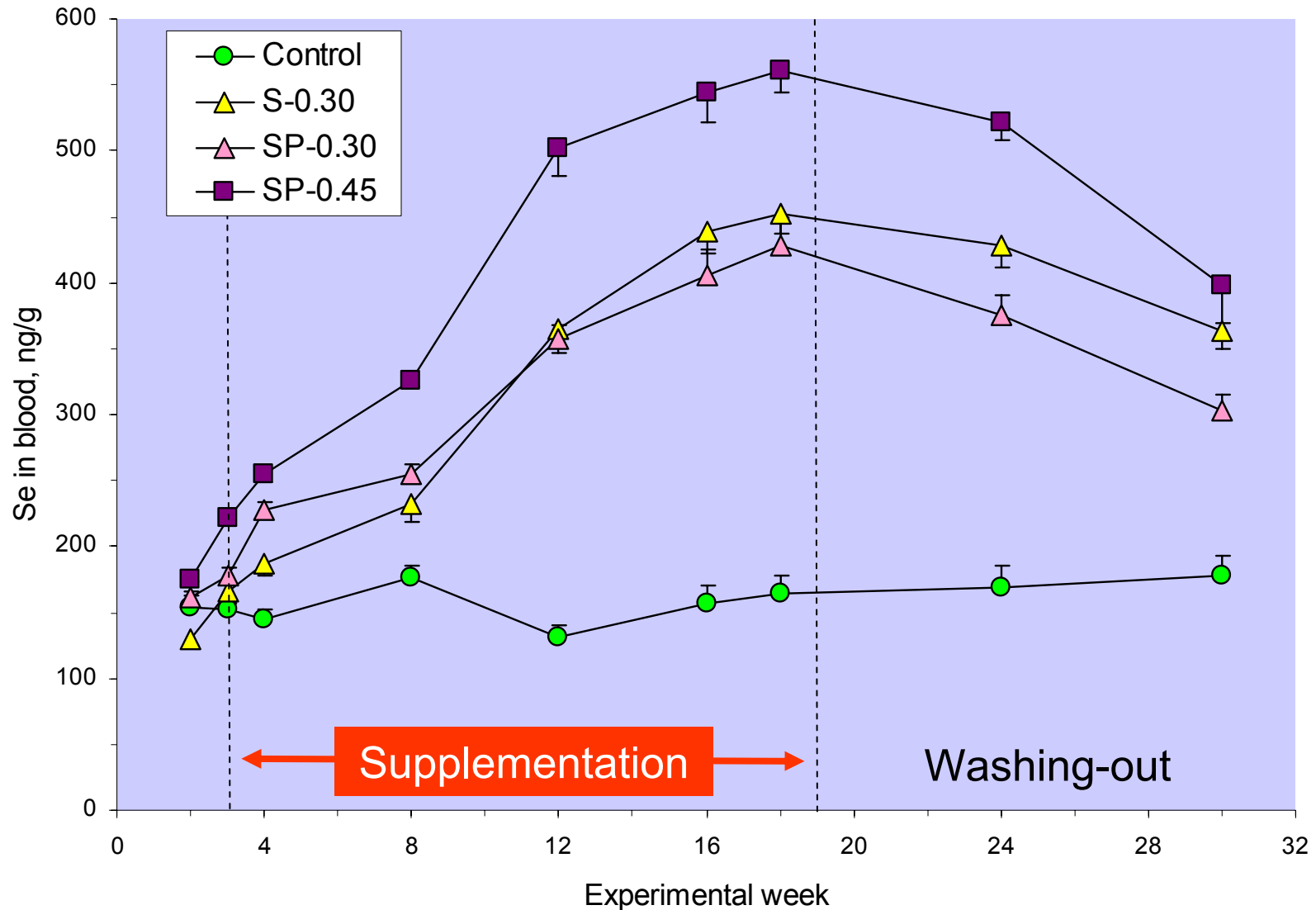


Se, ng/g	Treatment				±SE	P =
	Control	S-0.30	SP-0.30	SP-0.45		
Whole blood	155 <sup>c</sup>	329 <sup>b</sup>	313 <sup>b</sup>	391 <sup>a</sup>	13	0.001
Plasma	51.1 <sup>c</sup>	122.7 <sup>ab</sup>	113.0 <sup>b</sup>	131.7 <sup>a</sup>	4.5	0.001
Milk	9.2 <sup>d</sup>	13.8 <sup>c</sup>	19.5 <sup>b</sup>	39.7 <sup>a</sup>	0.9	0.001
Hair	482 <sup>c</sup>	730 <sup>b</sup>	699 <sup>b</sup>	900 <sup>a</sup>	39	0.001
Hooves	204 <sup>d</sup>	313 <sup>c</sup>	394 <sup>ab</sup>	350 <sup>bc</sup>	25	0.001

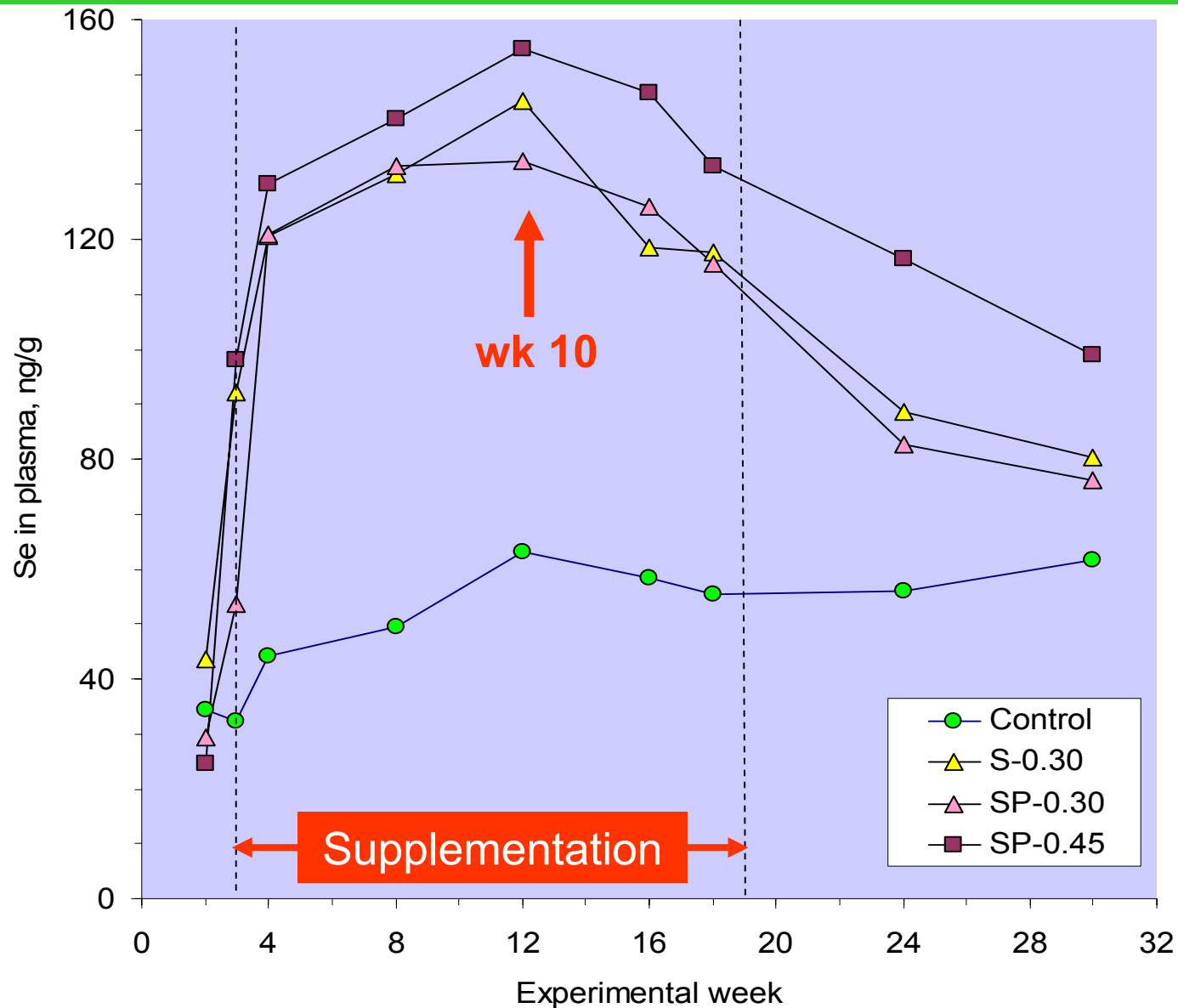


# Inorganic vs. organic Se in dairy goats:

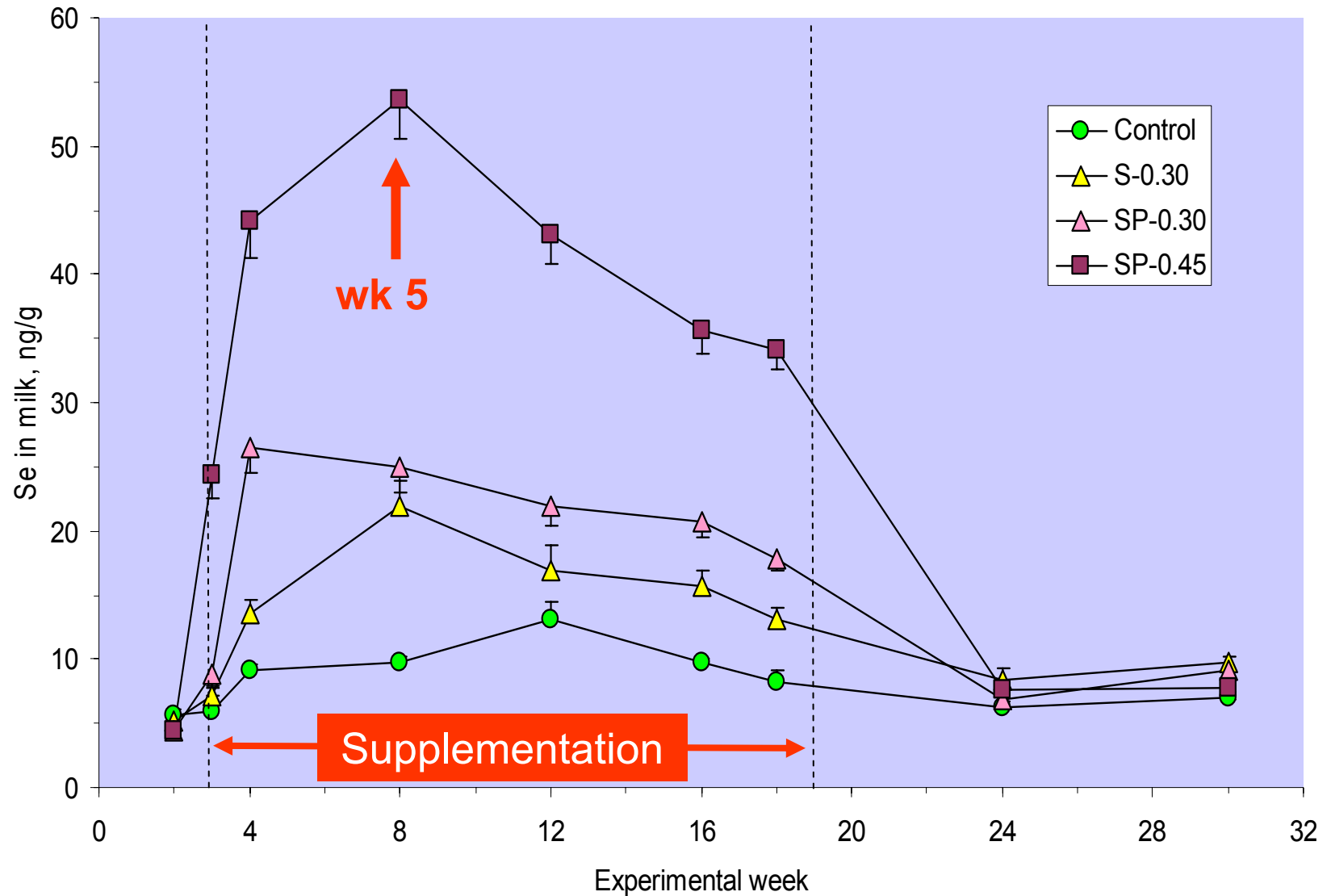
## 2.6. Results: Se in whole blood



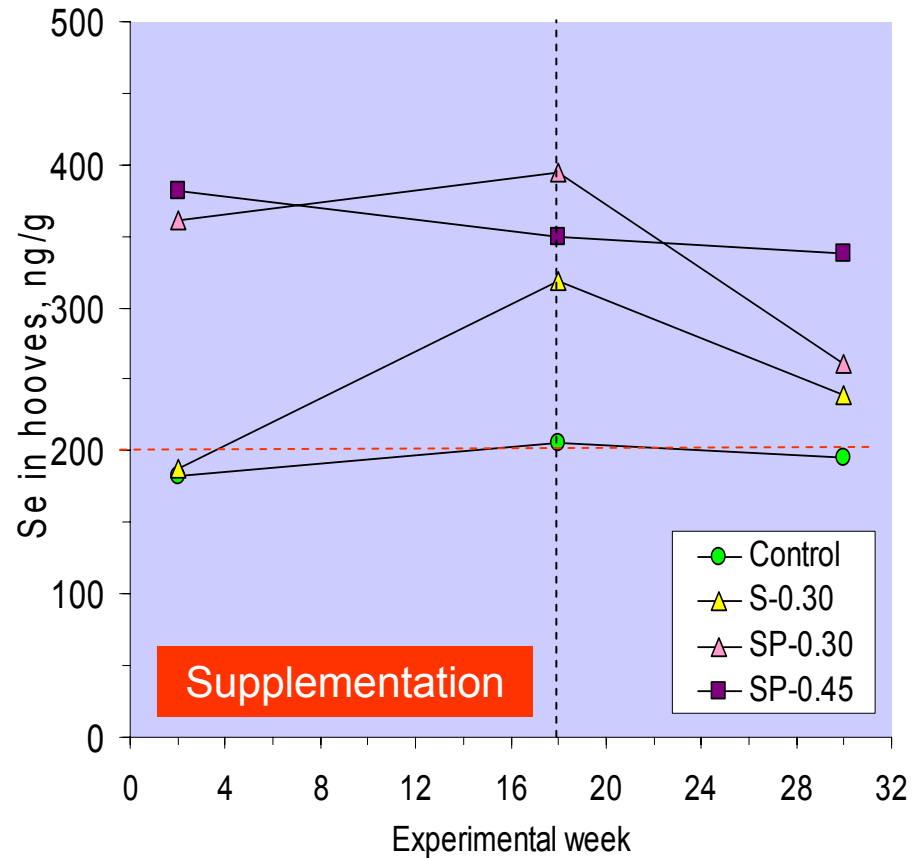
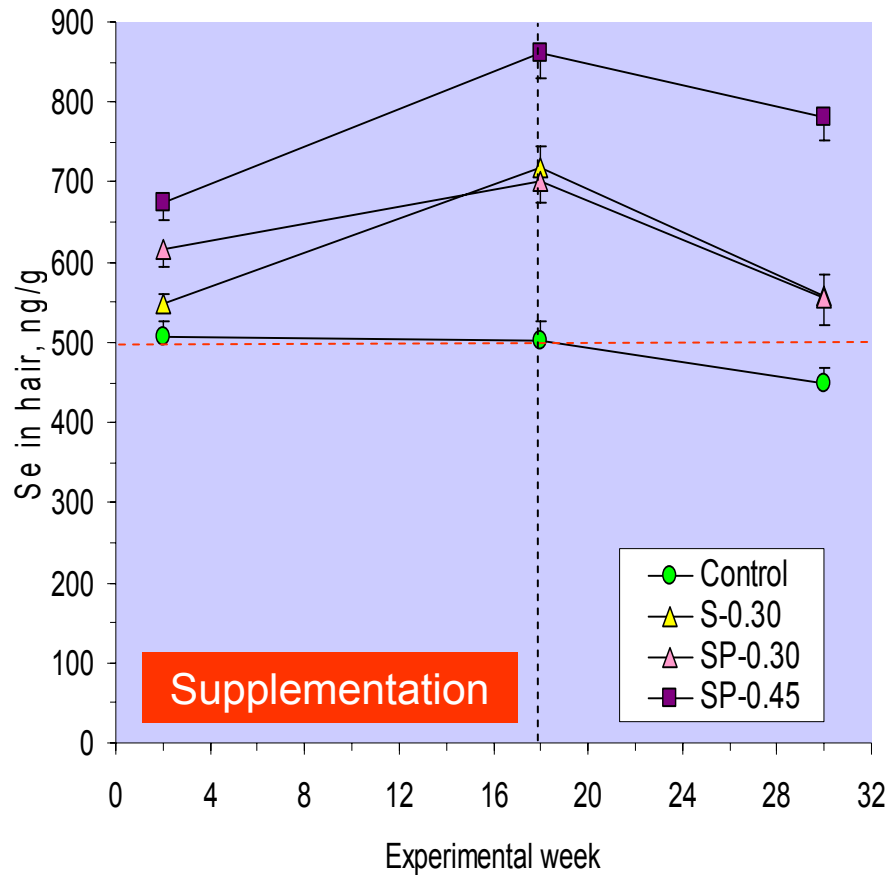
# Inorganic vs. organic Se in dairy goats: 2.7. Results: Se in plasma



# Inorganic vs. organic Se in dairy goats: 2.8. Results: Se in milk



# Inorganic vs. organic Se in dairy goats: 2.10. Results: Se in hair & hooves



Se > 500 ng/g (black & red hair)



# Inorganic vs. organic Se in dairy goats:

## 2.11. Results: Se in cheese & by-products



Se, ng/g	Treatment				±SE	P =
	Control	S-0.30	SP-0.30	SP-0.45		
Milk	15.5 <sup>c</sup> (100%)	27.0 <sup>b</sup> (174%)	26.5 <sup>b</sup> (171%)	60.5 <sup>a</sup> (390%)	0.7	0.001
Curd	18.0 <sup>c</sup> (100%)	41.0 <sup>b</sup> (228%)	41.5 <sup>b</sup> (231%)	134.0 <sup>a</sup> (744%)	0.9	0.001
Cheese	61.0 <sup>d</sup> (100%)	99.5 <sup>c</sup> (163%)	159.5 <sup>b</sup> (262%)	367.5 <sup>a</sup> (605%)	2.7	0.001
Whey	4.5 <sup>d</sup> (100%)	15.0 <sup>c</sup> (333%)	17.5 <sup>b</sup> (389%)	26.5 <sup>a</sup> (589%)	0.7	0.001

Expected increases of Se:

0.1 mg Se/kg DM feed = 0.020 mg Se/kg milk (20%)  
 = 0.008 mg Se/kg cheese (8%)

# Inorganic vs. organic Se in dairy goats:

## 2.12. Results: Se speciation in blood & milk



	Treatment			
	Control	S-0.30	SP-0.30	SP-0.45
Blood, ng/g				
Total Se	828 (100%)	1790 (216%)	1824 (220%)	1982 (240%)
Selenomethionine	182 (100%)	174 (96%)	267 (147%)	371 (204%)
Selenocysteine	540 (100%)	1437 (266%)	1395 (258%)	1438 (266%)
SeCys/SeMet ratio	2.97	8.26	5.23	3.88
Milk, ng/g				
Total Se	128 (100%)	199 (156%)	282 (220%)	606 (474%)
Selenomethionine	19 (100%)	24 (126%)	45 (237%)	117 (616%)
Selenocysteine	83 (100%)	149 (180%)	199 (240%)	331 (399%)
SeCys/SeMet ratio	4.37	6.20	4.42	2.83

# Inorganic vs. organic Se in dairy goats: Conclusions (1/2)



- No lactational effects were detected according to dietary Se supplement for diets containing 0.07 to 0.25 mg Se/kgDM.
- No toxicity symptoms were observed at the highest dose of Sel-Plex in the whole diet (0.25 mg/kgDM).
- Although SCC were unchanged, lower IMI incidence was reported when Sel-Plex was used.
- Hematology, blood chemistry & thyroidal hormones were partially affected by dietary Se supplement.
- Se content in blood, plasma, milk, cheese & hair increased dramatically according to dose of Se supplement.

# Inorganic vs. organic Se in dairy goats: Conclusions (2/2)



- Milk Se returned to control values after suppression of Se supplements.
- At same dose, Sel-Plex was more efficient than Selenite in increasing selenomethionine in blood and milk, indicating an improved bioavailability for lactating dairy goats.



**Thank you for attention!**

