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Increasing levels of condensed tannins from Sainfoin may reduce the environmental impact of pigs

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Background

- Tannins are phenolic plant secondary compounds widely distributed through the plant kingdom and at different levels in several animal feeding sources

- By complexing with feed nutrients (e.g. protein, carbohydrates cell wall components), tannins affect the digestibility of the diets

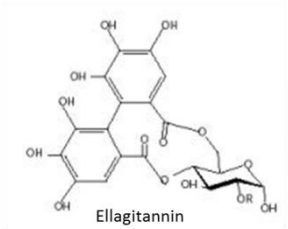
- Originally tannins were considered as anti-nutritional factors in diets for ruminants and monogastrics, as they negatively impact

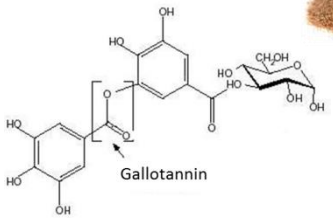
  - feed intake
  - nutrient digestibility
  - growth rate
  - feed efficiency

Background

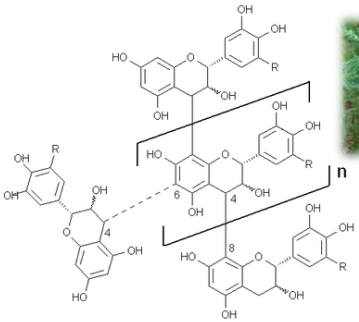
Those effects can vary according to the source, type and chemical structure of tannins, amount fed and animal species involved

Hydrolisable tannins (HT)





Condensed tannins (CT)



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Previous scientific evidence suggests that:

In pigs:

- dietary inclusion of CT from faba beans reduced the apparent digestibility of crude protein (**CP**) suggesting that CT can have a marked impact on the nitrogen (**N**) turnover *(Jansman et al., 1995)*

In ruminants:

- dietary CT from sainfoin shifted the N excretion from the urinary route to the feces *(Scharenberg et al., 2007; Grosse Brinkhaus et al., 2016)*

Beneficial from an environmental point of view as ammonia losses from feces are slower and less excessive than urine

Open question

- will **CT** decrease protein degradation in the gut of pigs, as shown in ruminants and decrease the urinary N excretion ?

Objective

Investigate the impact of increasing levels of **CT** from Sainfoin included in a grower-finisher diet on **N** digestibility and **N** turnover of entire male (**EM**) pigs

Material and Methods

Why Sainfoin?

Onobrychis viciifolia Scop.

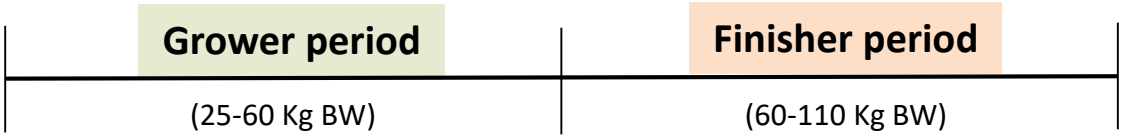
- Protein rich legume (CP > 22%)
  - partly replacement of soy bean?
- Elevated CT content (CT > 50 g/kg)

Material and Methods

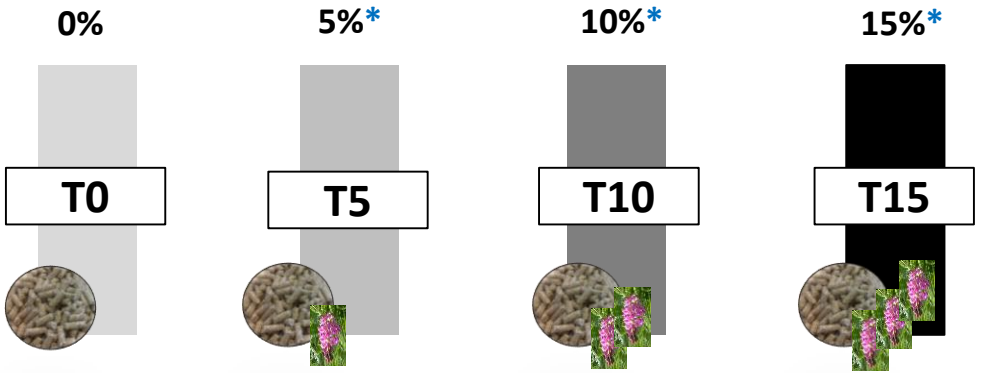
- 48 Swiss Large White entire male (**EM**)
  (12 per treatment)
- *ad libitum* access to the diets
- Pigs were reared in one pen equipped with 4 automatic feeders, in order to monitor individual daily feed intake

BW at start	24.8	±	5.1 kg
BW at slaughter	109.6	±	12.6 kg

Material and Methods



Treatments



* Sainfoin meal

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Experimental diets

Grower diet	T0	T5	T10	T15
Barley, %	42.2	29.3	16.4	3.4
Corn, %	17.4	23.2	29.0	34.8
Wheat, %	13.4	16.7	20.1	23.4
Soy meal, %	16.2	13.9	11.5	9.2
Fat blend, %	1.0	1.6	2.3	2.9
Sainfoin, %	-	5.0	10.0	15.0
Analyzed nutrient composition (g/Kg DM)				
Crude protein	163.8	163.1	159.7	161.2
Lysine	10.4	10.6	10.7	10.9
Methionine	3.0	3.1	3.2	3.4
Threonine	6.6	6.7	6.9	7.0
Crude fat	36.7	44.5	52.3	60.2
Crude fiber	33.8	35.9	38.0	40.1
Digestible energy (MJ/kg DM)	13.5	13.5	13.5	13.5

Finisher diet	T0	T5	T10	T15
Barley, %	10.0	10.0	10.0	10.0
Corn, %	53.2	38.8	24.4	10.1
Wheat, %	8.9	22.4	35.8	49.3
Oats, %	10.2	6.8	3.4	-
Soy meal, %	13.2	11.5	9.7	7.9
Fat blend, %	0.1	1.3	2.5	3.6
Sainfoin, %	-	5.0	10.0	15.0
Analysed nutrient composition (g/Kg DM)				
Crude protein	156.8	154.5	153.1	151.3
Lysine	8.7	8.9	9.1	9.2
Methionine	2.5	2.5	2.5	2.6
Threonine	5.6	5.7	5.9	6.0
Crude fat	50.0	52.7	55.4	58.1
Crude fiber	44.1	43.4	42.6	41.8
Digestible energy (MJ/kg DM)	13.5	13.5	13.5	13.5

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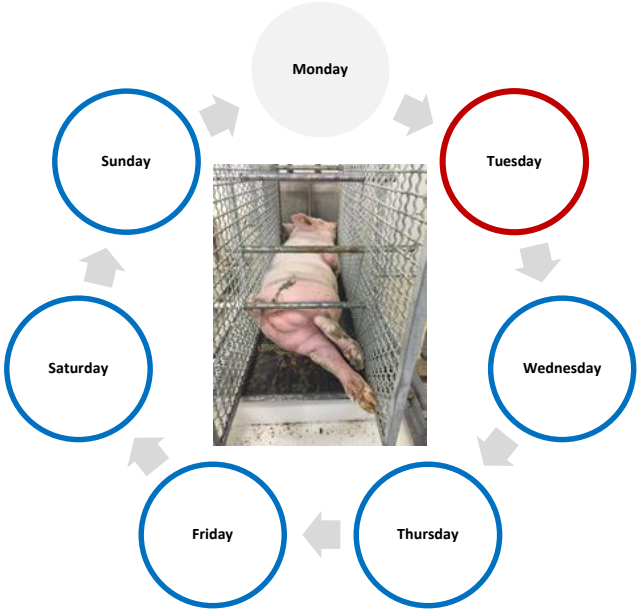
N - balance

Grower period (50-53 Kg BW)

Finisher period (75-79 Kg BW)



- 24 littermates (6 per treatments)
- 1 d - adaptation period
- 5 d - collection period

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Traits of interest

- **Growth performance**
  (from 25 - 110 kg BW)
  - ADG
  - ADFI
  - G:F ratio
- **Digestibility**
  (at 50 and 75 kg BW)
  - DM
  - N
- **N-balance**
  (at 50 and 75 kg BW)
  - N-intake
  - N-feces
  - N-urine
  - N-total excretion
  - N-body retention
  - Urea in urine

Data analysis with SAS 9.3

Anova

Fixed effect:
- Experimental groups

Random effect:
- Litter

Results - Growth performance

			Experimental groups					
			T0	T5	T10	T15	SE	P-value
25 - 60 kg BW	ADG	kg/d	0.91	0.84	0.92	0.87	0.06	0.42
	ADFI	kg/d	1.85	1.75	1.91	1.79	0.12	0.39
	G:F	kg/kg	0.49	0.48	0.48	0.49	0.02	0.87
60 - 105 kg BW	ADG	kg/d	0.96	0.90	0.99	0.99	0.04	0.34
	ADFI	kg/d	2.52	2.37	2.65	2.50	0.17	0.33
	G:F	kg/kg	0.38	0.38	0.38	0.40	0.02	0.50
20 - 105 kg BW	ADG	kg/d	0.94	0.87	0.96	0.94	0.05	0.31
	ADFI	kg/d	2.22	2.09	2.32	2.17	0.13	0.23
	G:F	kg/kg	0.42	0.42	0.41	0.43	0.01	0.53

ADG: Average daily gain; **ADFI**: Average daily feed intake; **G:F**: Gain to feed ratio

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Results - Intake and digestibility of DM and N

		Experimental groups					
		T0	T5	T10	T15	SE	P-value
50 - 53 kg BW	Daily intake (gr/d)						
	DM	1587	1597	1586	1484	85.8	0.77
	N	46.6	46.0	45.3	42.7	2.5	0.69
	Digestibility (%)						
	DM	88.1^{a}	85.8^{b}	85.7^{b}	86.2^{ab}	0.55	0.02
	N	87.0^{a}	80.5^{b}	79.9^{b}	79.0^{b}	1.15	<0.001
75 - 79 kg BW	Daily intake (gr/d)						
	DM	2133	1907	2132	1874	229.9	0.40
	N	59.0	52.1	58.3	51.2	6.3	0.35
	Digestibility (%)						
	DM	89.7^{a}	87.5^{b}	86.0^{bc}	85.3^{c}	0.50	< 0.001
	N	90.2^{a}	85.4^{b}	82.1^{c}	80.8^{c}	0.83	< 0.001

DM: Dry matter; **N**: Nitrogen

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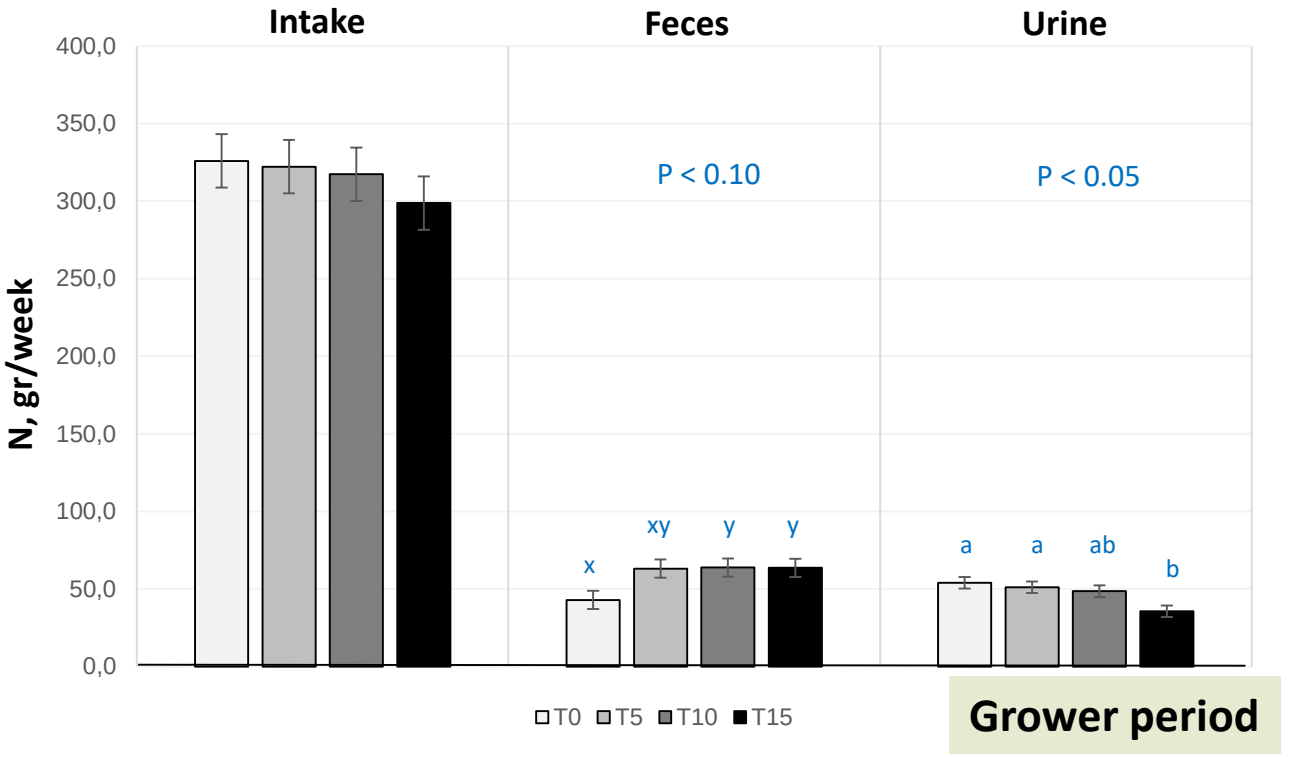
Results - N-intake and N-excretion in the grower period



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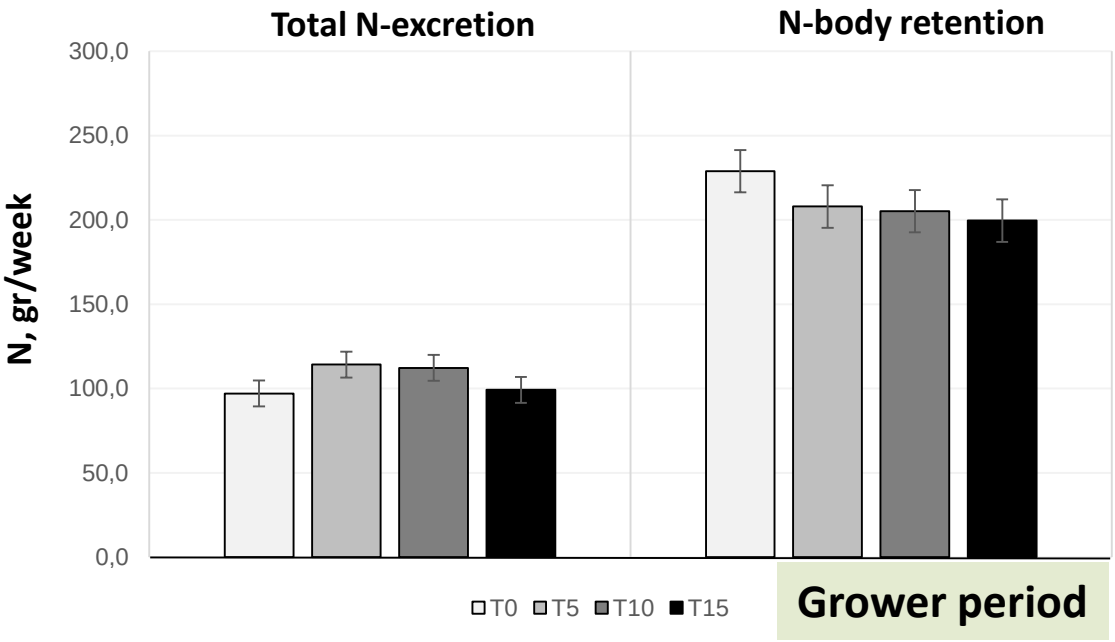
Results - Total N-excretion and N-body retention



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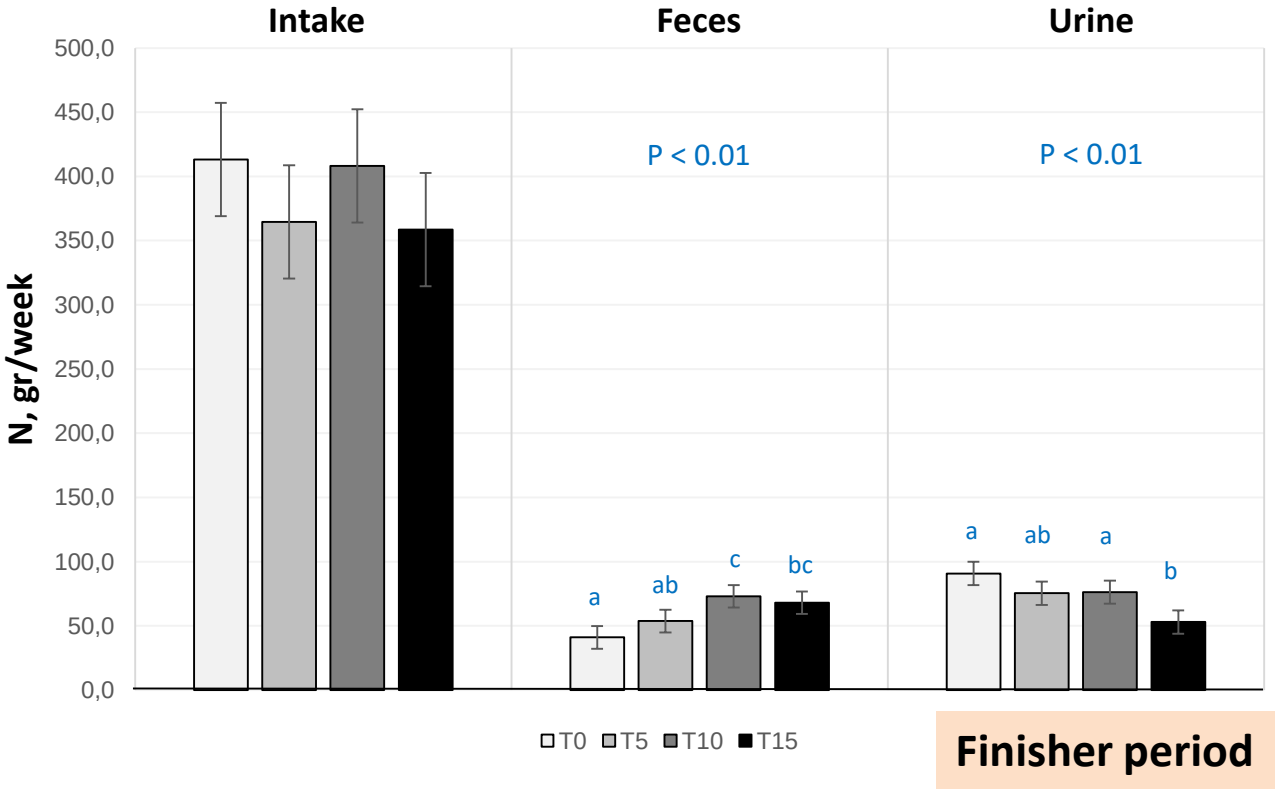
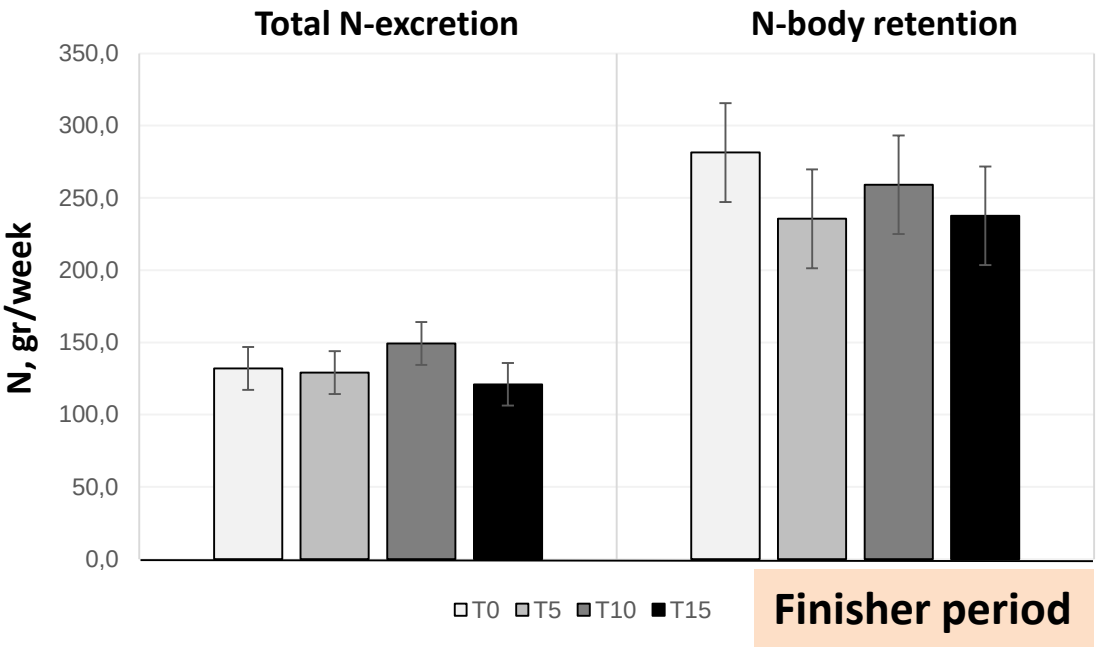
Results - N-intake and N-excretion in the finisher period



Results - Total N-excretion and N-body retention



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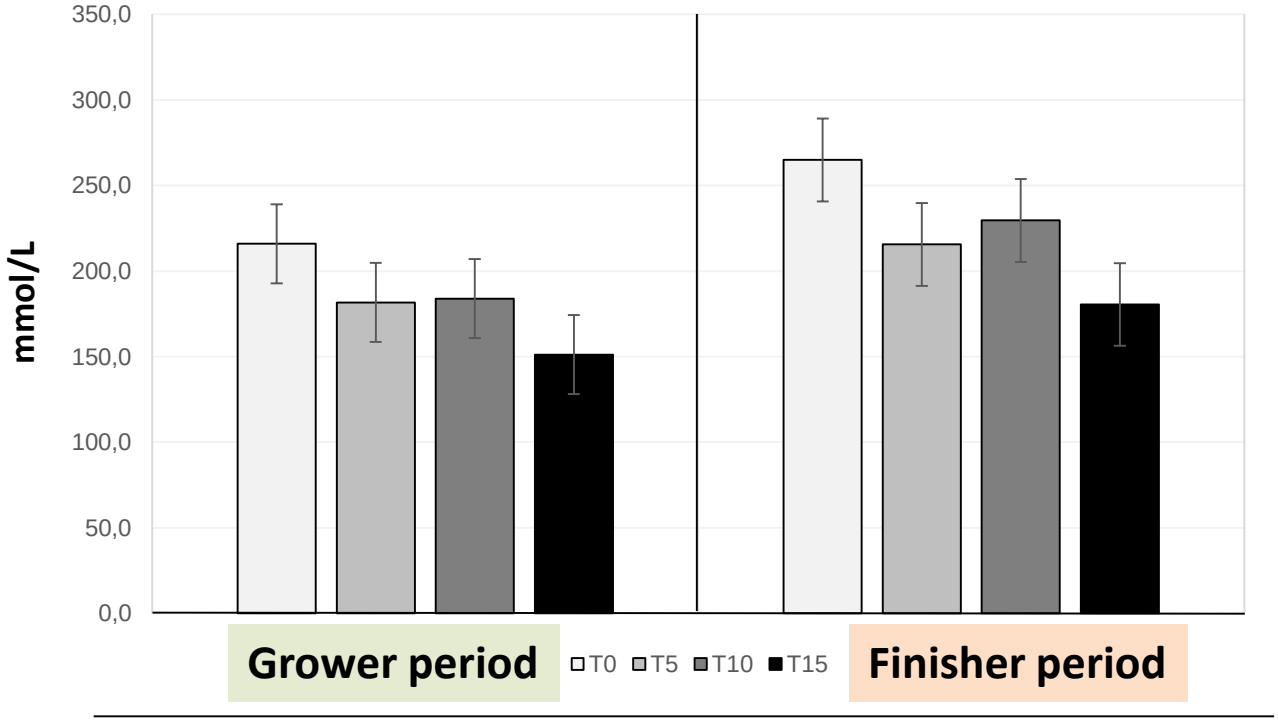
Results - Urinary urea concentration



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Conclusions

Increasing levels of **CT** from Sainfoin

- Reduced urinary N excretion by
  - 31.5% in the grower period
  - 32.3% in the finisher period
- Increased fecal N excretion by
  - 48.2% in the grower period
  - 78.8% in the finisher period

Future studies?

Thank you for your attention

Agroscope good food, healthy environment