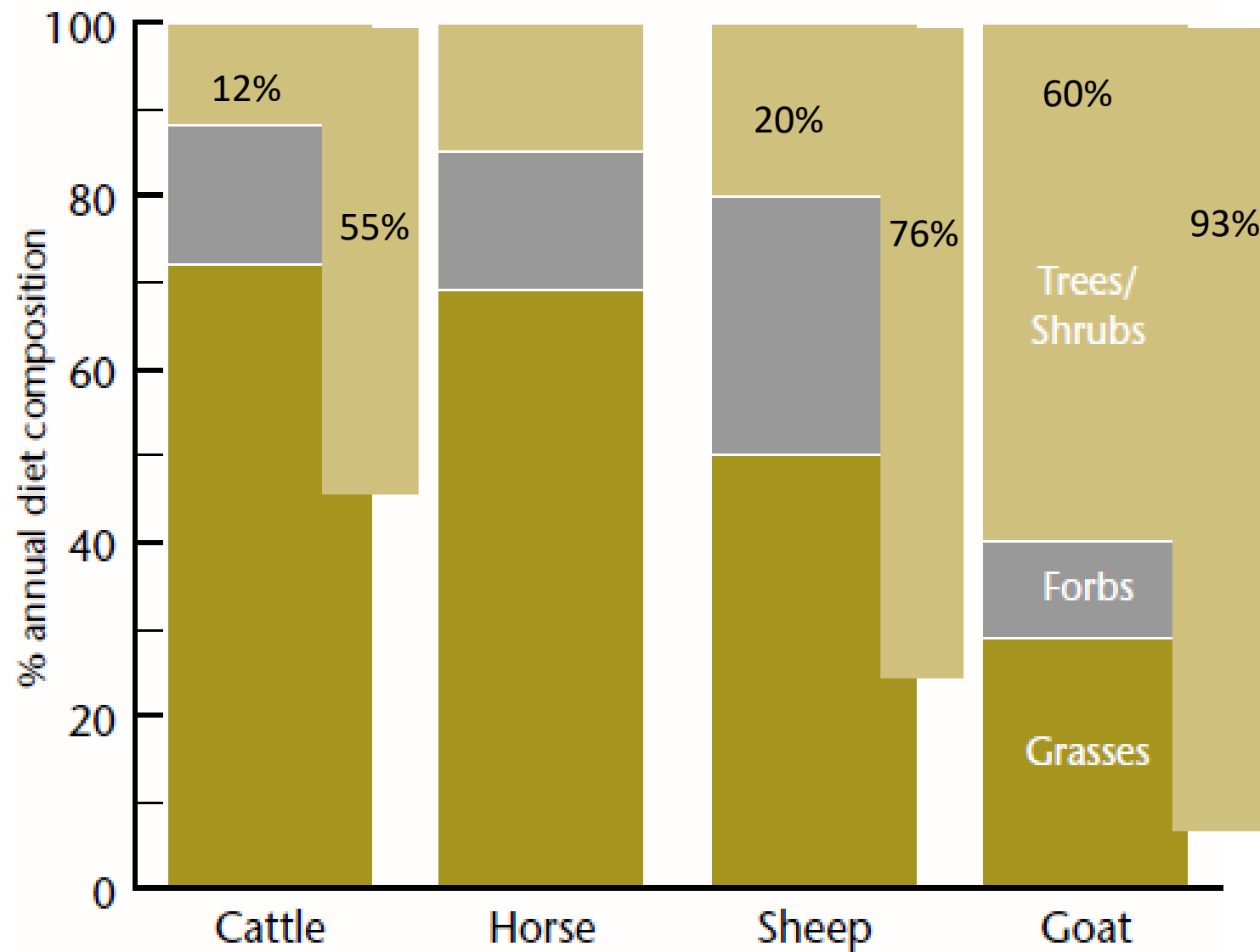


The value of trees as supplementary fodder

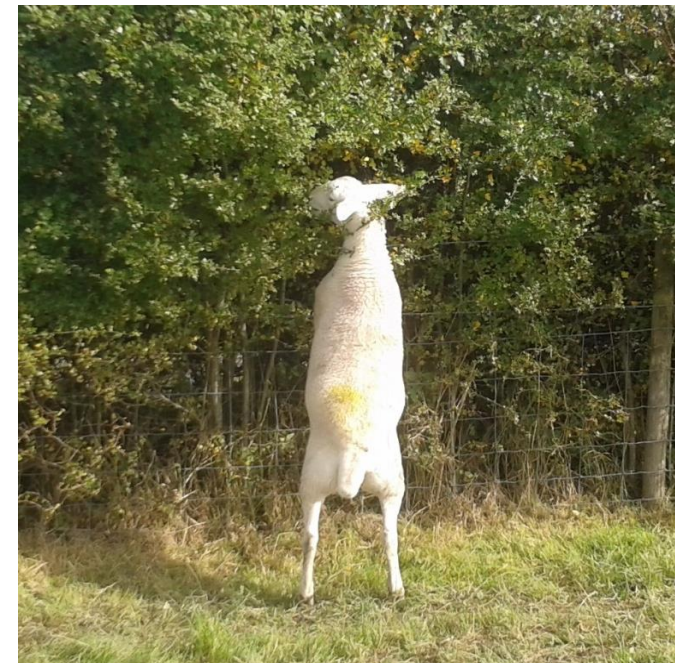
Dr. Lindsay Whistance



Variation in the diet of domestic stock



<http://www.forestry.gov.uk>; Dicko and Sikena, 1992



Palatability

Tree species

1	Aspen, Willow
2	Ash, Rowan
3	Hazel, Oak
4	Scots pine, Juniper, Holly
5	Birch, Hawthorn
6	Beech
7	Alder

Notes on the table:

•In lowland woodlands aspen may be in palatability **class 3**.

•**Scots pine, juniper and holly** are more preferred in **winter** than summer because they are evergreen, however, young holly shoots, before the leaves have hardened, are also often taken.

N.B. There is ongoing debate about whether holly and hawthorn should be higher up the list. They are often seen heavily browsed but this may be only when all other species are either more heavily browsed or are not there at all.

Hedge: field maple, sycamore, hornbeam, dogwood, hazel, hawthorn, ash, black poplar, oak, false acacia and elder.

All species were browsed at least once except false acacia

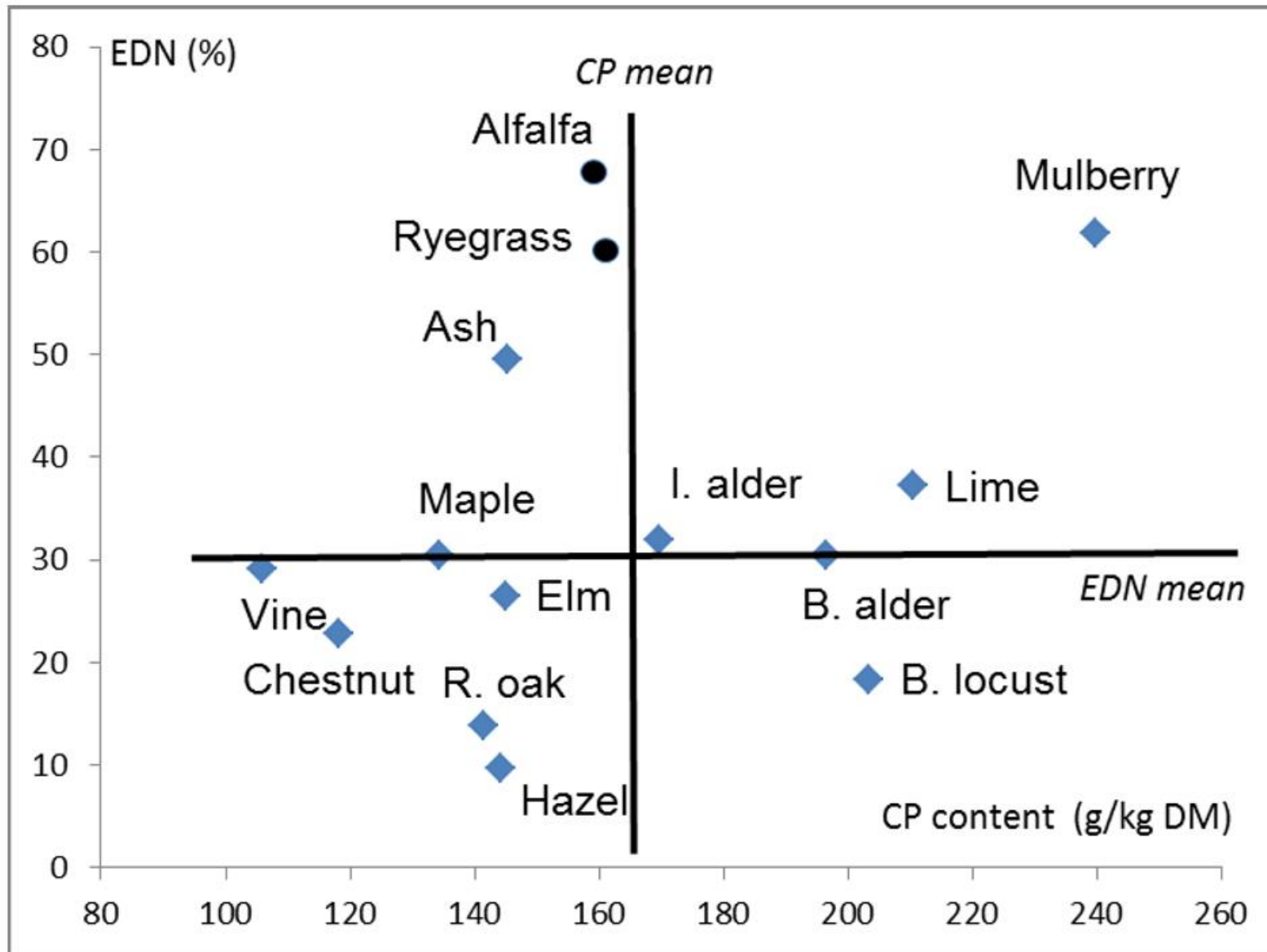
Vandermeulen et al 2016

Heifers (May – September)	Time spent browsing (%)	Species preferred
Spring	19.3	Hazel Hawthorn Hornbeam
Early summer	5.9	
Late summer	5.4	

Leaf nutrition in tree species compared to hay and red clover (%). In: Birks et al, 1989.

Tree species	Moisture	Ash	Fat	Sugar	Protein	Fibre
Wych elm	12.6	9.9	2.9	49.2	13.2	12.3
Rowan	11.9	5.9	6.5	50.4	9.9	15.4
Goat willow	11.5	6.1	3.8	50.3	11.6	16.7
Aspen	10.8	8.5	6	43.5	13.3	20.9
Ash	11.6	6.3	3	50.4	12	16.7
Grey alder	11.9	3.9	5.9	43.6	17.6	17.4
Birch	11.7	3.9	7	49.2	12	16.2
Meadow hay	14.96	5.42	2.2	44.43	8.51	24.56
Red clover	15.65	5.17	1.88	36.76	10.98	28.56

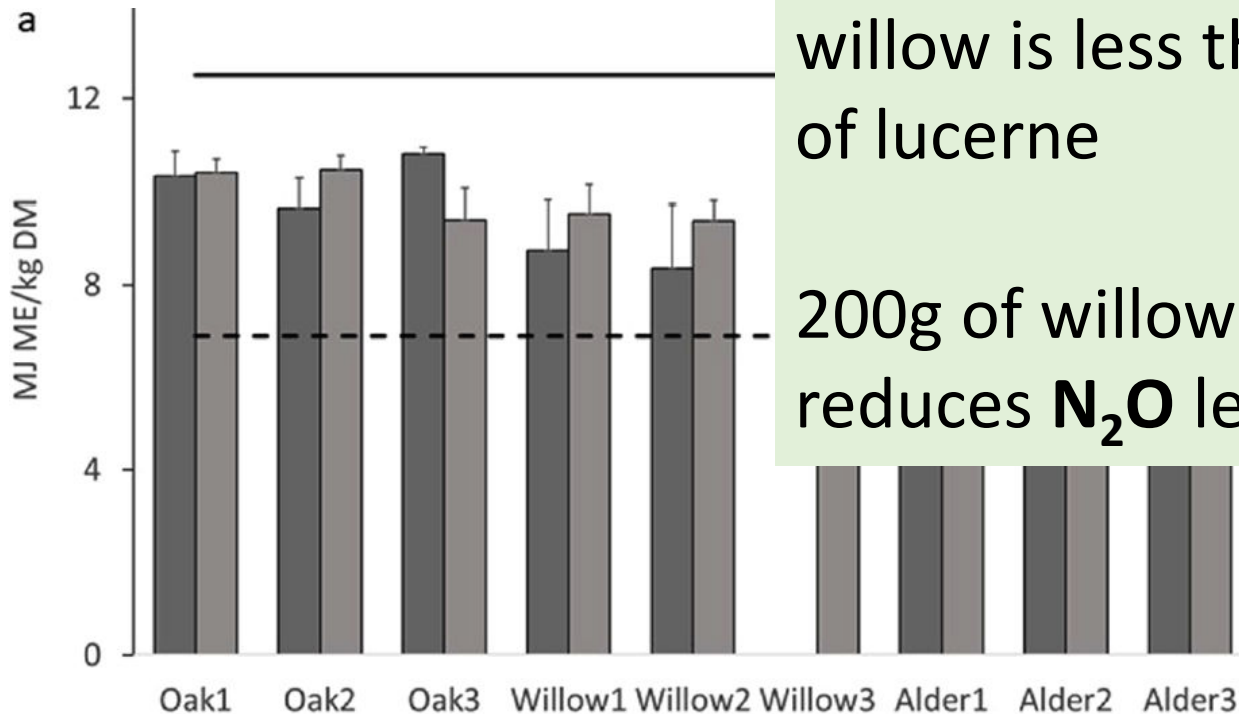
Relationship between effective degradability of nitrogen (EDN, %) and nitrogen concentration (CP, g/kg DM) in leaves of woody species during summer. (Emile et al., 2016)



3 Species:
Oak, Alder, Goat willow

3 Sites:
Berkshire, Leicestershire
Gwynedd

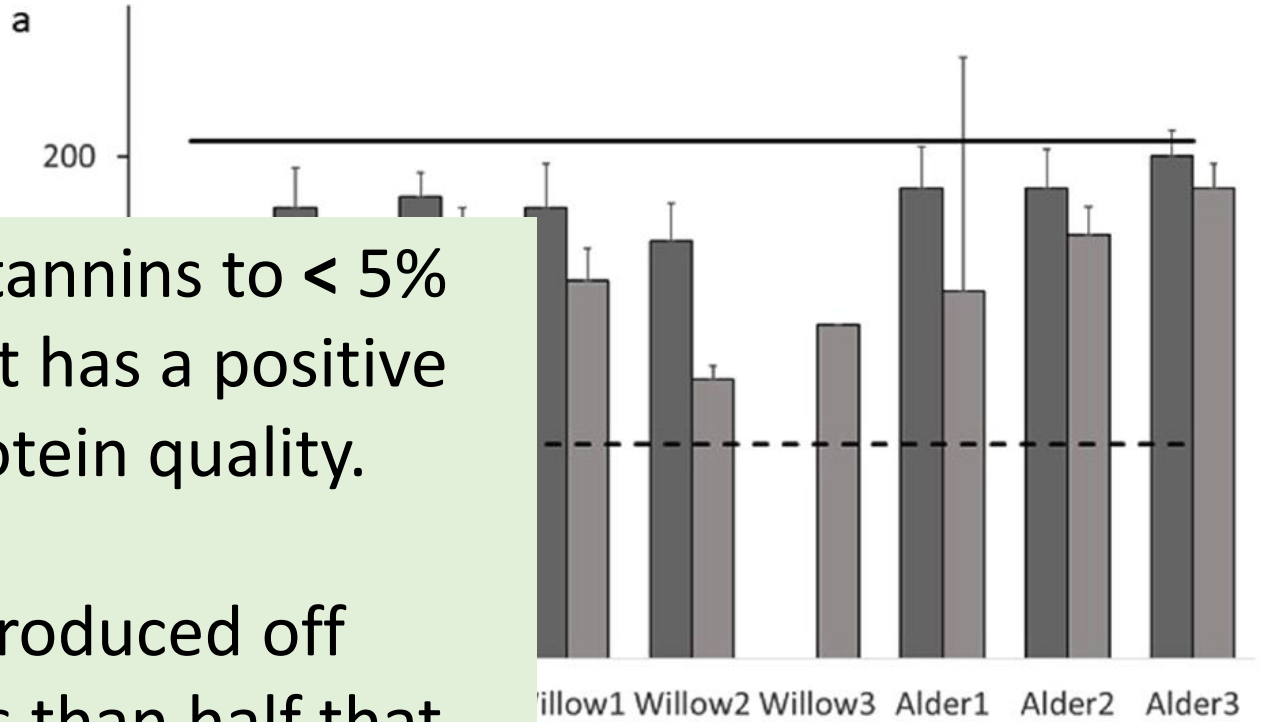
2 months:
June (dark grey)
September (light grey)



Condensed tannins to < 5% of DM in diet has a positive effect on protein quality.

CH₄ (ml/g) produced off willow is less than half that of lucerne

200g of willow leaves per day reduces **N₂O** levels in urine

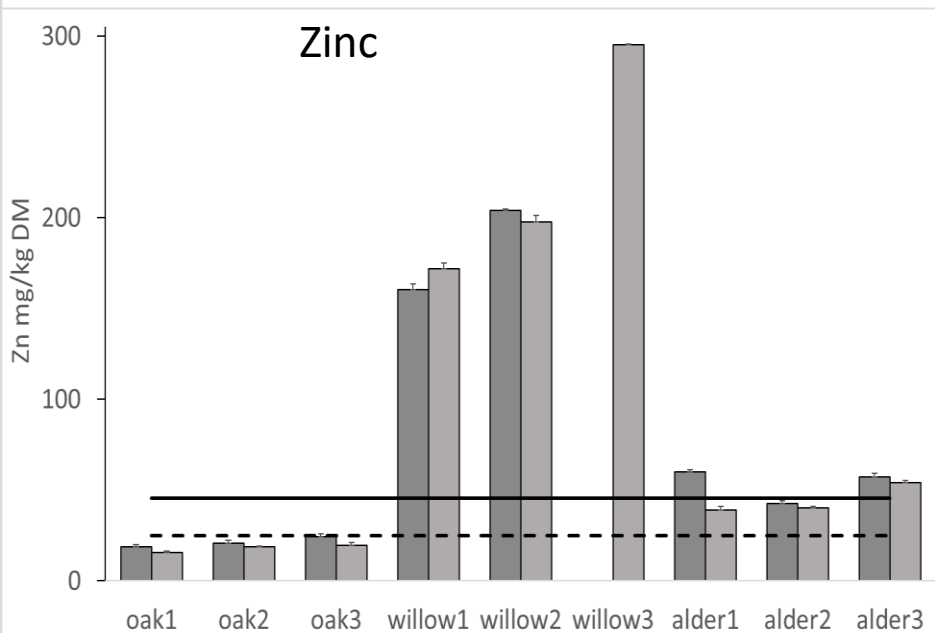
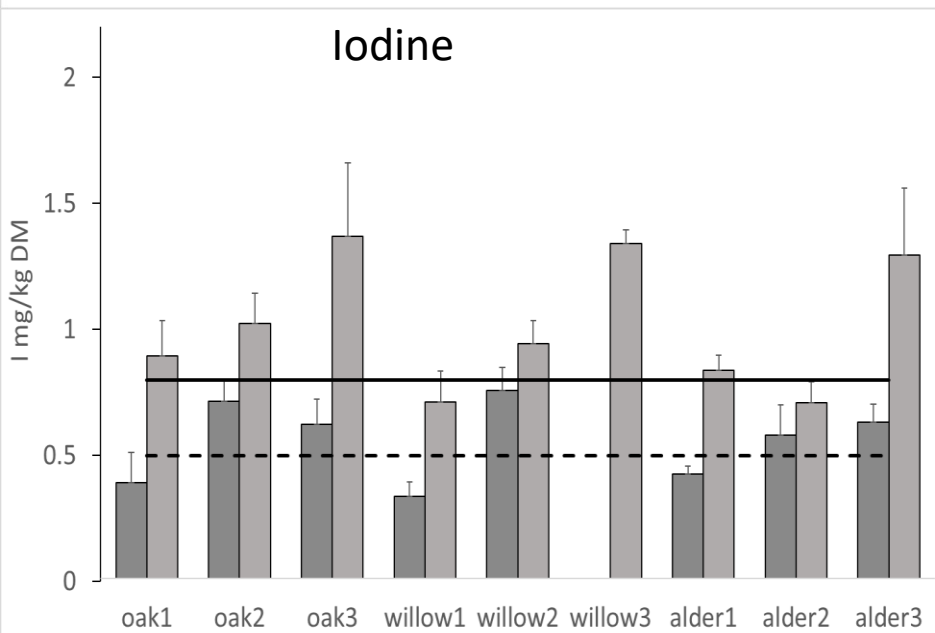
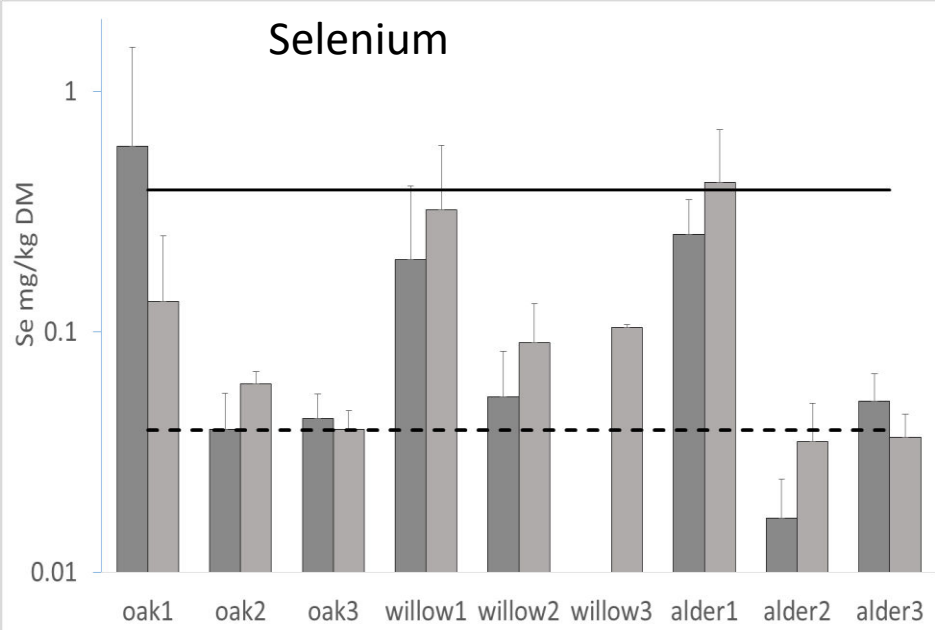
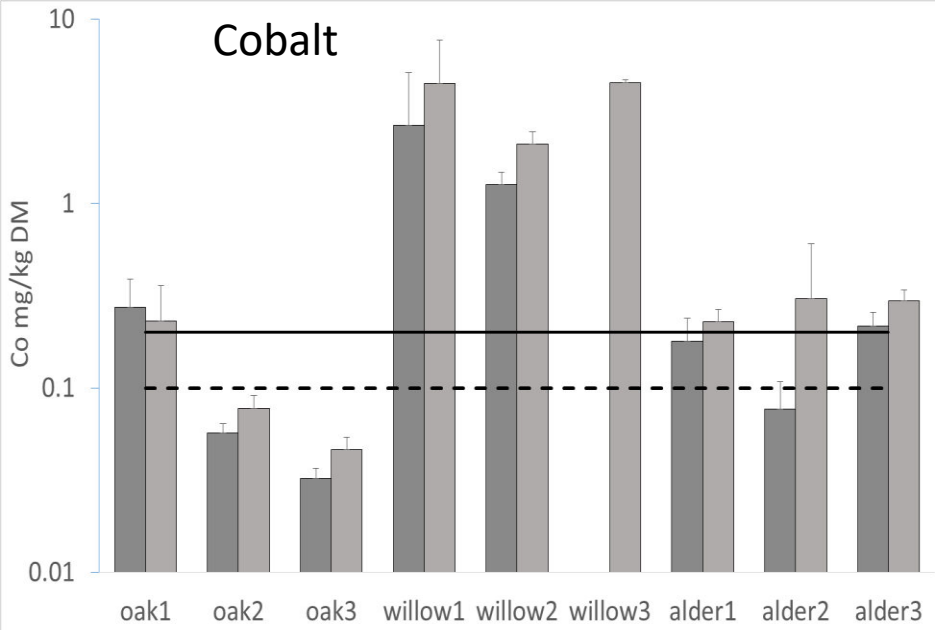


Growing lamb requirements:

— 20kg; 250g/d

- - - - 40kg; 150g/d

(Kendall et al., 2021)



Selected minerals
 Sheep requirements:
 — Upper range
 - - - Lower range

Influences on mineral content: species, time of year and geographical location

	tree	site	time	treexsite	treexsite	treexsite
Ca	***	**	***	***	**	*
P	ns	*	***	***	ns	*
Mg	***	ns	ns	***	*	*
Na	***	***	***	***	ns	**
K	***	***	ns	***	ns	**
Cu	***	***	***	***	ns	tr.
S	***	**	ns	*	***	***
Fe	***	***	ns	***	***	***
Mo	***	ns	ns	**	*	ns
Mn	*	*	***	***	*	ns
Pb	***	tr.	***	***	ns	*
Cd	***	***	ns	***	ns	ns
As	**	**	ns	***	**	**
B	*	ns	***	***	**	**
Al	ns	ns	**	*	ns	ns
Ni	**	ns	*	*	ns	tr.
Se	ns	**	ns	ns	ns	ns
Co	***	*	*	*	tr.	ns
Zn	***	***	ns	***	ns	ns

For minerals:

Species is the strongest single influence followed by location.

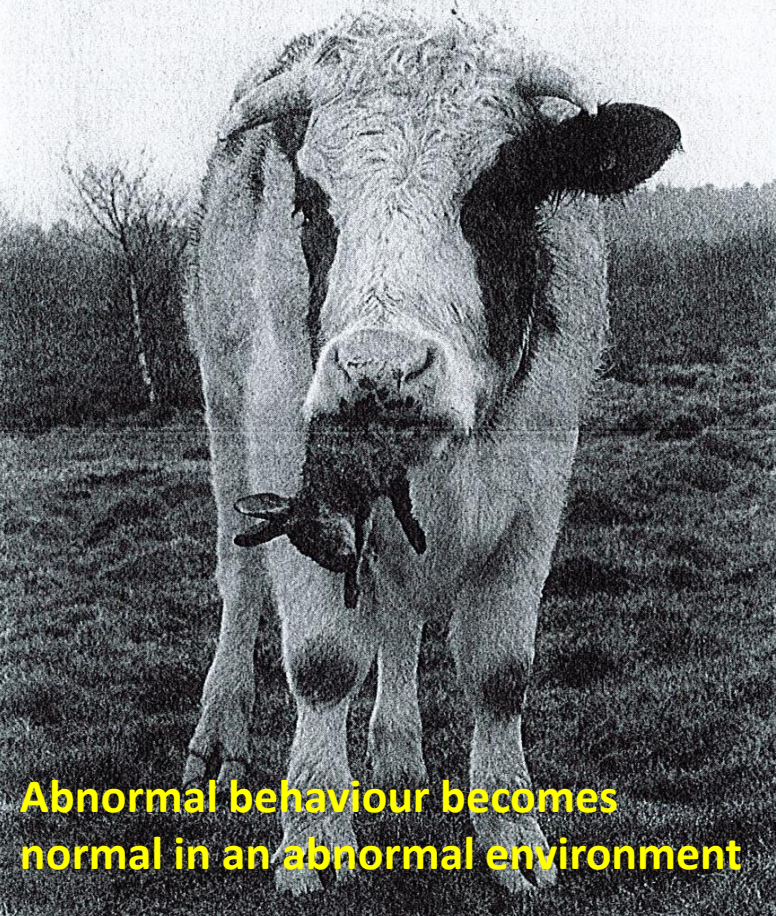
It appears that time of harvest is less important than for protein content.

Kendall NR, Smith J, Whistance LK, Stergiadis S, Stoate C, Chesshire H, Smith, AR (2021) Trace element composition of tree fodder and potential nutritional use for livestock. *Livestock Science* 250:104560 DOI: <https://doi.org/10.1016/j.livsci.2021.104560>

Minerals higher in stored tree fodder

Harvested July, Analysed fresh, Stored until following March. Analysed stored. Fed to housed cattle

	State	Fresh	Stored	Fresh	Stored	Fresh	Stored	Stored	Stored	
Sample	Unit	Ash	Ash	Elm	Elm	Goat willow	Goat willow	Alder	Osier willow	Benefits
Nitrogen DUMAS	% w/w	1.78	2.21	2.23	2.31	2.66	2.16	3.16	2.23	
Phosphorus	mg/kg	3144	3661	2292	2362	4243	5501	2240	2971	Skeleton, reproduction, milk production
Potassium	mg/kg	14065	20015	14722	20884	13942	18977	9051	10364	
Calcium	mg/kg	12776	15987	10998	16758	10204	14522	13365	18769	Skeleton, muscles, heart, blood clotting, cell membranes
Magnesium	mg/kg	2235	2681	1889	2798	1930	2682	2481	1764	
Sulphur	mg/kg	1840	2348	1313	1655	2056	2571	1890	4124	Feed efficiency, growth
Manganese	mg/kg	25.5	31.6	37.2	37.9	35.5	46.3	129	284	Bone, nerve endings, enzymes
Copper	mg/kg	7.4	9.6	6.5	9.3	7.6	10.9	11.2	5.5	
Zinc	mg/kg	18.5	22.9	31.7	40.1	118	144	53.2	245	Protein metabolism, skin integrity
Iron	mg/kg	91.2	116	138	258	75.7	142	91.6	73.1	
Boron	mg/kg	15.7	17.5	19.3	26.0	12.7	18.2	28.9	36.7	Bone density, wound healing, embryo development
		Fraxinus excelsior		Ulmus minor		Salix caprea		Alnus glutinosa	Salix viminalis	

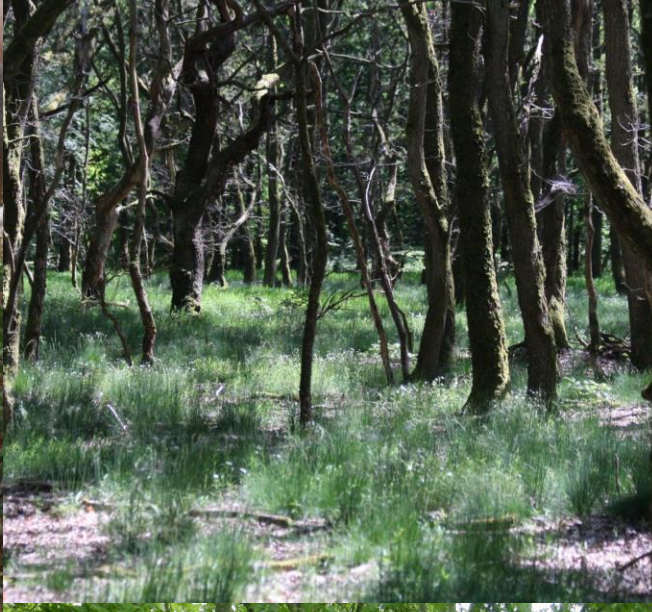


Abnormal behaviour becomes normal in an abnormal environment

Salicin content in willow

<u>Scientific name</u>	<u>Common Name</u>	<u>Salicylic Acid (mg/g FW)</u>
<i>S. daphnoides</i>	European violet willow	3.21
<i>S. caprea</i>	Goat Willow	1.95
<i>S. fragilis</i>	Crack willow	1.65
<i>S. viminalis</i>	Osier willow	0.21
<i>S. alba</i>	White Willow	0.2





Re-Livestock: Facilitating Innovations for Resilient Livestock Farming Systems (2022-2026)

Aims: to evaluate and mobilize the adoption of innovative practices in livestock systems to increase their capacity to deal with climate change impacts.

Level: considered cross-scale at animal, herd, farm, sector and regional levels and focus areas will include animal feeding, breeding, welfare, management, environmental and socio-economic assessments along with policy analysis.

Action: integrated approaches developed for dairy, beef and pig systems in different geographic regions. Co-innovation and design are important to ensure relevance and promote adoption. Stakeholder contributions include national farmer groups and forums, with a European platform for knowledge sharing.

Use of woodlands for dairy cows in summer



Dairy cows fed silage beneath a woodland canopy to reduce heat stress in summer
<https://www.thescottishfarmer.co.uk/news/20294900.dairy-farmers-can-keep-cows-heat/#gallery0>

Trial: Mitigating summer heat stress for livestock.

Grazing animals are typically exposed to full solar radiation unless some shade is provided. If offered access to woodland, do they use this to shelter from the sun and is it effective? A herd of pasture-based dairy cows will be equipped with data loggers to investigate how weather conditions influence cow behaviour and heat stress levels.

Willow as tree fodder: production and nutrition



<https://www.feed-pellet-mill.com/>



Pelleting and woodchipper machinery

<https://opereviews.com/trees-forestry/wood-chippers/>

Trial: Willow as tree fodder: production and nutrition

Utilising trees as animal feed is gaining interest with farmers increasingly recognising their value on farm. Storing and feeding tree fodder for winter use is attractive but currently requires a lot of time and space for harvesting and storing. Investigating chipping and pelleting for storing and feeding. Are they efficient feeding methods and is there nutrient loss?



And we bring you
news by word of
mouth –

Good news for
cattle and corn –

Now is the Sun
come up from the
South,

With Oak, and Ash,
and Thorn!

Thanks for listening

Kipling, 1927