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Tree Fodder Technical Guide

The historical and modern use of tree fodder as supplementary feed

Agricology

About this guide

Feeding tree fodder to livestock was once an important part of normal husbandry practice in traditional farming systems. It was typically available to animals as fresh browse or harvested and fed either fresh or dried (commonly referred to as tree hay) and then fed during the winter months. A third practice was to release stock into (particularly ash) woodlands for them to feed on fallen leaves in the autumn. With an increasing need to focus on sustainable and resilient farming systems, the reintroduction of this practice has real potential to make a meaningful contribution. This guide brings together peer-reviewed research and anecdotal evidence of what farmers might need to know when considering tree fodder as an integral part of their farming system. It looks at livestock browsing behaviour, nutritional, mineral and medicinal value, potential impacts on animal health and welfare, and ways of producing, harvesting and feeding tree fodder. Key author, Dr Lindsay Whistance, focusses her work on aspects of farming systems which support good human-animal-relationships and lives worth living for farmed animals and particularly through the lens of the organic principles.

Trees and shrubs: a natural part of animal diets

Domesticated farm animals, though classed as predominantly grazers, will readily browse on trees and shrubs where they are given access. When moved to fresh grazing, they will typically seek out browse opportunities before grazing (see below).

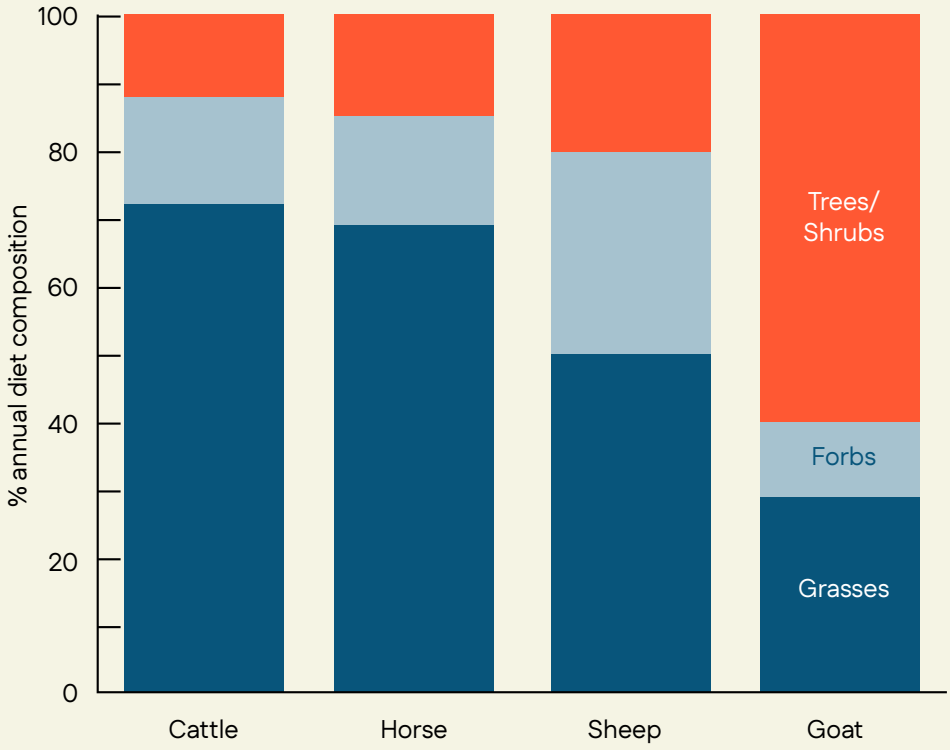
Where availability is restricted, they will work hard to get at difficult-to-access browse, for example, by risking being shocked by an electric fence (see below). Where there is unrestricted access in a plant-rich landscape, a typical daily feeding pattern, at least for cattle, is to fill up on grazed plants at each end of the day and to be more selective during the middle of the day.

Hereford cattle browsing on a mixed-species hedgerow
Photo: Lindsay Whistance

A Jersey cow risking an electric shock to browse on hedgerow elm
Photo: Lindsay Whistance

Though all domesticated species can and will browse, some are evolutionarily better adapted to higher levels of browsing than others. For example, goats have larger livers for their body size compared to sheep or cattle, which increases their ability to cope with a higher intake of anti-nutritional factors. Goats and deer also produce a salivary protein that binds condensed tannins, reducing their anti-nutritional effects.[3,24] That said, all species can readily digest meaningful amounts of tree fodder as part of a wider diet (Table 1) and nutrient digestion is then optimised when populations of associated gut microflora are maintained. At times, browse intake can increase dramatically, including during dry seasons, where there is minimal fresh grazing available, or in springtime when there is an abundance of young growth. At these times, intake can rise to around 55% of the daily diet of cattle, 76% for sheep and 93% for goats.[13]

Table 1: Composition of diet for domestic stock and horses.
(Woodland Grazing Toolbox, modified: https://www.forestry.gov.scot/woodland-grazing-toolbox)



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Familiarity, palatability, hunger and health status all play a role in an individual animal's food choices. In terms of familiarity, the strongest learning about edible plants and food preferences come from the dam and this conditioning is happening even before an animal is born via the amniotic fluid and then later through flavours in the milk. Prior to birth, the mother's diet may also be key in preparing the offspring for feeding on diverse solid foodstuffs since pioneer microbiota are already being transferred to the foetus from early gestation.[1] As a juvenile, plant selection is strongly influenced by watching what the dam eats (see below) and then copying her feeding behaviour. Observing and copying a dam's feeding choices are powerful influences and strongest in younger offspring. These influences are known to last for at least five years in cattle and three years in sheep.[56,20]

A calf watching its dam browse on hawthorn
Photo: Lindsay Whistance

Where browse/tree fodder is introduced as a novel food, animals can take time to familiarise themselves before optimising intake. For example, in a New Zealand trial looking at feeding freshly cut willow to cattle during hot and dry weather, when grass growth was sparse, their daily intake of willow increased from 1.5 kg to 3.5 kg over the 81 days of the trial. At the same time, the diameter of willow stems eaten increased from about 4 mm to 8 mm.[30] For weaned lambs, over a 70-day trial, browsing on thicker stems also increased over time up to 4 mm diameter.[12] The cattle trial had two treatments with differing amounts of tree fodder supplementation and those on the lower allowance (4 kg/day) tended to eat thicker stems than those on the higher allowance (8 kg/day). It is suggested that it takes 55 days for naive animals to increase their intake sufficiently to prevent weight loss during drought conditions, and that supplementation should therefore be occurring before grass growth is compromised if any loss of condition is to be avoided.[30] It will also take time for the gut microbiota to develop sufficiently for optimal digestion of available nutrients from browse.

In UK, beyond browsing behaviour, the traditional key fodder trees were wych elm (*Ulmus glabra*), ash (*Fraxinus excelsior*) and holly (*Ilex aquifolium*), with the latter grown as winter browse for cattle and particularly sheep. Historically, elm and ash were preferred fodder trees in many European countries including Switzerland and Denmark.[47] Troels-Smith writes: '*Of all the trees known... ...the leaves of which may be used as fodder, elm and ash are considered the best*',[47] but most native and naturalised tree species are edible to stock to some degree. With the decline in elm in Denmark (considered to be because of an over-reliance on this species for fodder in early farming systems), lime (*Tilia*) then became a favoured fodder tree. In Switzerland, piles of leaves of elm, ash, lime, birch (*Betula*), oak (*Quercus*) and maple (*Acer*) were found in a Neolithic farming homestead with evidence of ivy (*Hedera*) as a fodder in a nearby byre.[21,46]

From the animal's point of view, not all trees are equally attractive as browse (Table 2) and some, for example alder, are often not browsed (even by wild deer). The reason for the lack of voluntary browsing is not clear, particularly as their nutritional content is comparable to other trees that are readily browsed. Some browsing of alder does occur, particularly as young regrowth from coppiced stocks, indicating either unpalatable plant secondary metabolites or an unpleasant texture in more mature leaves. Ranking palatability is not straightforward since the level of browsing of any given species will be determined by many factors including mechanical (e.g. hairy or spiky leaves or thorns) and chemical (anti-nutritional factors, or ANFs) properties of plants, the health status and hunger levels of the animal, and subsequent, post-ingestive feedback conditioning future attractiveness. Alongside this are factors such as species abundance, and seasonal, site and climate influences.

Table 2: Palatability of trees and shrubs (based predominantly on observations over time). (Woodland Grazing Toolbox, modified. https://www.forestry.gov.scot/woodland-grazing-toolbox)

Tree species (earlier ranking)	**Relative Palatability** (1 = most palatable, 6 = least palatable)	**Tree species** (more recent, updated ranking)
Aspen, Willow	1	Aspen, Ash, Elder, Willow
Ash, Rowan	2	Elm, Hazel, Holly, Oak, Rowan
Hazel, Oak	3	Blackthorn, Douglas fir, Wild cherry, Hawthorn, Larches, Sycamore
Scots pine, Juniper, Holly	4	Birch, Beech, Lodgepole pine, Scots pine
Birch, Hawthorn	5	Bird cherry, Juniper, Norway spruce, Western hemlock
Beech	6	Alder, Rhododendron, Sitka spruce
Alder	7	

In a trial looking at dairy heifer browsing preferences in the Netherlands, where they had access to a multi-species hedge, the heifers spent approximately 20% of their feeding time browsing in the spring compared to around 6% in the summer. Of the species available to them (field maple, sycamore, hornbeam, dogwood, hazel, hawthorn, ash, black poplar, oak, false acacia and elder) their preferences were to browse on the hazel, hawthorn and hornbeam in spring, though all of the species – except the false acacia (*Robinia pseudoacacia*) – were browsed at least once throughout the trial.[49]

Early 20th century rankings of the value farmers placed on trees as fodder have been compiled in Norway and Switzerland, and whilst ash and elm remain high and alder remains low, other named species vary considerably in their position, with willow being historically considered a poor fodder tree, at least in Norway. In contrast, it is ranked high for palatability as browse in Scotland (Table 2) and willow (spp) is currently garnering much interest as a fodder tree. Elder also ranks high in the Woodland Grazing Toolbox list[58], though there is less evidence of it being a consistently, highly preferred browse tree elsewhere. There may be some differences in the animals' and farmers' perceived value of each species as a source of fodder, as well as differences in attractiveness between fresh browse and preserved fodder. Additionally, the actual species of tree may not always be identifiable in all records where only the genus name is recorded (e.g. elm versus wych elm), leaving room for misinterpretation.

For browsing animals, some caution is required in relation to specific species of trees or tree parts (wood, bark, leaves or fruit/seeds) which may contain concentrated levels of ANFs. The ANFs can also fluctuate during seasonal changes or from stress caused by physical damage or a hostile climate. These chemical defences help protect plants and seeds against herbivory. A typical example are acorns, which can be a valuable source of nutrients for pigs, and whilst they can be eaten in smaller amounts by cattle, sheep and horses, they can prove fatal in larger quantities. Context is important when determining what is a poison for animals and whether smaller quantities also have any medicinal benefits, or whether any effects of ingesting ANFs are cumulative. For example, the effects of eating cyanogens present in wilted wild cherry leaves are not cumulative, so whilst one bout of overeating may result in death, an animal can eat several times a single lethal dose over time if browsed in smaller quantities and with sufficient time in-between for the gut to process the toxins.[9] Generally, hunger or a lack of specific nutrients in the diet increases the likelihood of any animal eating/overeating plants, increasing any subsequent risk of disease.[36]

Macronutrients

A general rule of thumb is that the nutritional content of tree fodder is similar to that of grasses and forbs grown in the same environment. A trial of tree fodder, hay and clover fed to stock in Norway at the beginning of the 20th Century (Table 3) indicated that tree hay is, in fact, superior in fat, sugars and protein content when compared to the meadow hay and red clover controls. However, they were crude nutrient levels with no indication of how much was available to the animal or when each crop was harvested during the growing season.

An old Norwegian saying about tree fodder lists the outcomes of feeding four different species to livestock (from Stoltenberg, 1933[44]): 'Elm feeds, ash manures, alder starves, willow fells (the animal, from malnutrition).' It is noteworthy that despite both alder and willow being regarded as providing poor nutrition in Norway, they were still fed to the animals, (Table 3) indicating the need to harvest all available fodder. Given the reported levels of macronutrients for both alder and goat willow being comparable to other species, it is likely that ANFs are an influence here though levels of condensed tannins are lower in dried leaves which may increase palatability.

Willow
Photo: Janie Caldbeck

Records state that the least palatable fodder species were fed in early winter, saving the most palatable fodder for building up animals before the following spring turn-out.

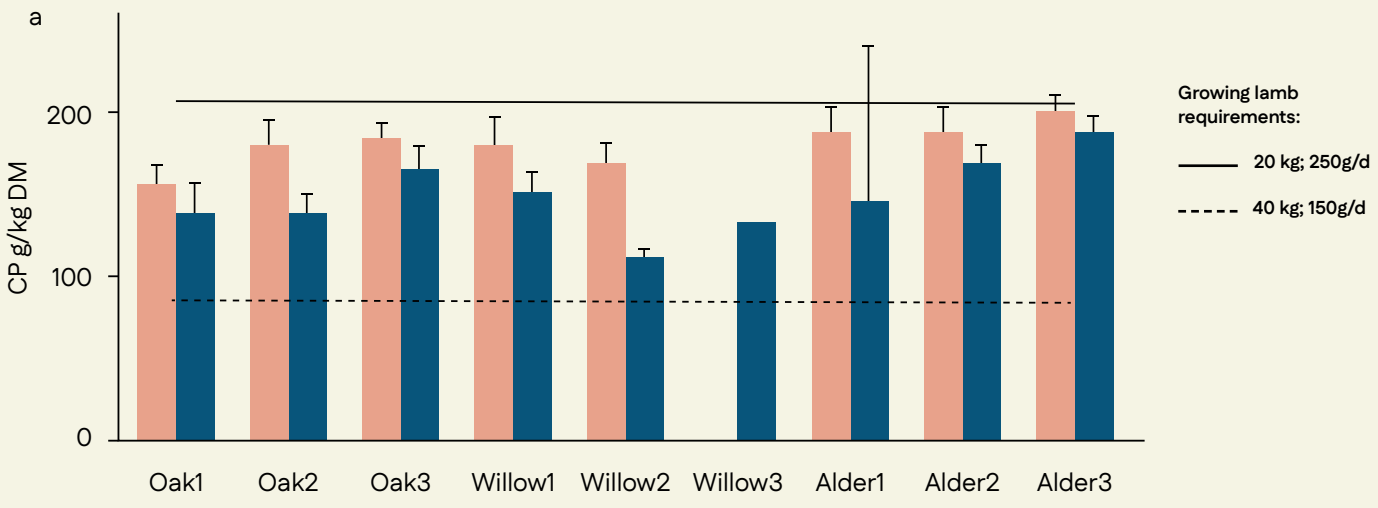
Table 3: Leaf nutrition in tree hay compared to hay and clover in Norway. (From Lunde, (1917) in Birks et al., (1989); modified)

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	6.0	43.5	13.3	20.9
Ash	11.6	6.3	3.0	50.4	12.0	16.7
Grey alder	11.9	3.9	5.9	43.6	17.6	17.4
Birch	11.7	3.9	7.0	49.2	12.0	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

Cows grazing at Strickley Farm, Cumbria
Photo: Duncan Elliott

More up-to-date research in the UK (Figure 4) supports these early results, indicating that tree fodder from oak, goat willow and alder, harvested in June and September, can provide sufficient energy and protein for 40 kg growing lambs.[23] In ideal conditions, tree fodder should be considered as a useful supplementary feed rather than a replacement for pasture fodder, particularly when containing higher levels of antinutritional factors. Despite low levels of voluntary intake compared to other palatable trees, alder continues to be of interest in research trials, partly due to its nitrogen-fixing potential.

Figure 4: Tree fodder samples harvested in June (coral) and September (dark blue) from 3 different geographical locations in England and Wales. (Kendall et al., 2021; modified).



A trial carried out in France looked at the nutritive values of eleven different tree species (Table 4) harvested in August from trees managed as hedgerows, standards and pollards. As a source of nutrients for dairy cows, the white mulberry and ash were considered superior fodder trees, followed by the large-leaved lime, alder and Italian alder.[15] The sweet chestnut, hazel and red oak were considered to be of insufficient quality as a feed for dairy cows, though it is interesting that hazel was a preferred browse species in spring for the dairy heifers in the Dutch trial.[49] The authors also looked at the proportion of crude protein available to the animal in the leaves (effective degradable nitrogen or EDN) and concluded that lower levels of EDN in some tree species were likely influenced by the presence of condensed tannins which can inhibit the digestion of protein in the rumen.[15]

Mulberry leaves contain low levels of condensed tannins and total digestibility is high at around 800 g/kg.[8,42] White mulberry has the potential to be grown as a protein forage crop in temperate, sub-tropical and semi-arid climates.[14] The results from the trial in England and Wales[23] indicate that, had the tree fodder in France been harvested earlier than August, the protein content would likely be higher still. Alongside tree species, the study found that the method of tree management also affected nitrogen levels, with pollarded trees yielding higher protein content than standard, tall canopy trees.[15] Similar benefits were recorded from short-rotation coppiced trees, alongside the re-growth from managed trees producing a higher leaf-to-stem ratio and lower lignin levels compared to unmanaged trees.[5]

Table 4: The relationship between crude protein (CP, g/kg DM) and available protein (EDN, % and g/kg) in tree leaves compared to lucerne and ryegrass. Ranked according to protein availability. (Emile et al., 2016; modified).

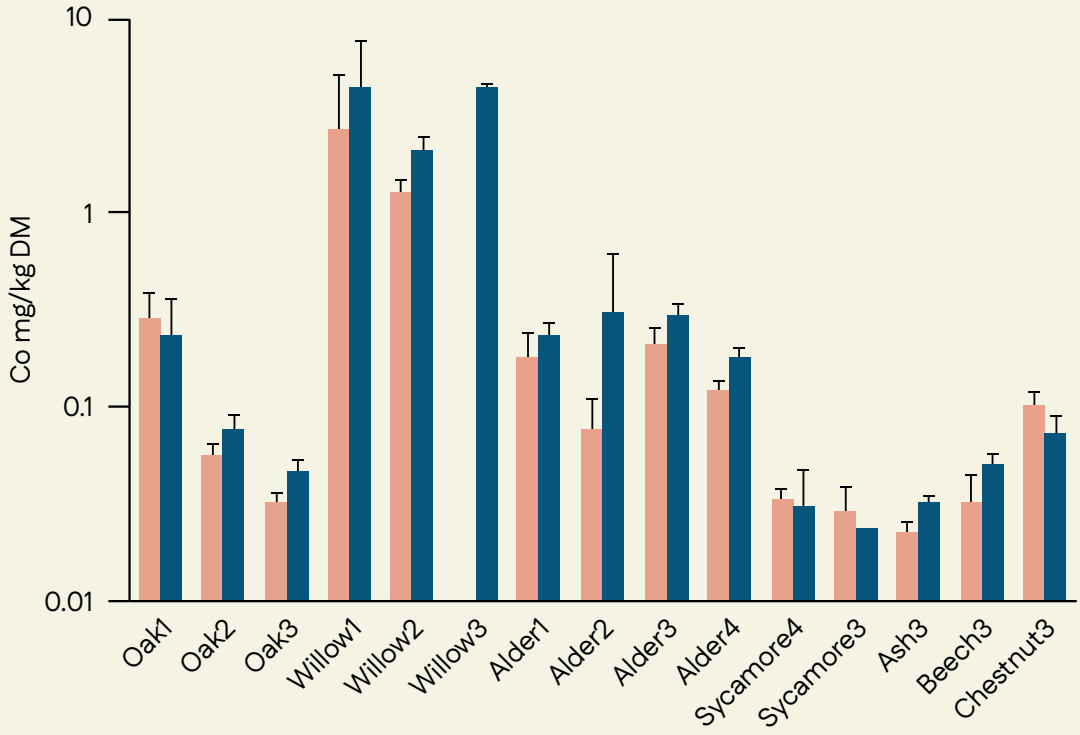
Species	Latin name	DM (g/kg DM)	CP (g/kg DM)	EDN (%)	EDN (g/kg)
White mulberry	*Morus alba*	369	240	62	148.80
Lucerne	*Medicago sativa*	284	159	68	108.12
Perennial ryegrass	*Lolium perenne*	368	161	60	96.60
Large leaved lime	*Tilia platyphyllos*	365	211	37	78.07
Ash	*Fraxinus excelsior*	376	145	50	72.50
Black alder	*Alnus glutinosa*	373	197	31	61.07
Italian alder	*Alnus cordata*	369	170	32	54.40
Field maple	*Acer campestre*	515	134	30	40.20
Field elm	*Ulmus minor x resista*	421	145	27	39.15
Black locust	*Robinia pseudoacacia*	398	204	18	36.72
Chestnut	*Castanea sativa*	426	118	23	27.14
Red oak	*Quercus rubra*	473	142	14	19.88
Hazel	*Corylus avellana*	420	144	10	14.40

Lambs eating willow at Mindrum Farm
Photo: Innovative Farmers

Minerals

Tree fodder offers great potential as a mineral supplement for farmed animals, and the level of minerals present will depend largely on the species, plant parts harvested, location, and the season, but there is still much to learn. When testing mineral content in the leaves of different species from three different locations over two seasons, the species of tree was the strongest influence on mineral content, followed by location.[23] That said, examples of species, site and seasonal differences were evident in the trial. The levels of zinc and cobalt were highest in the goat willow across all sites and seasons. Willow is a known accumulator species of zinc which is an important mineral for skin health and optimal metabolic functioning. For weaned lambs, supplementary cobalt is typically required to support late summer grazing (Figure 5).

Figure 5: Levels of cobalt in tree species in June (coral) and September (dark blue) at different sites in England and Wales. (Kendall et al., 2021; Modified.)



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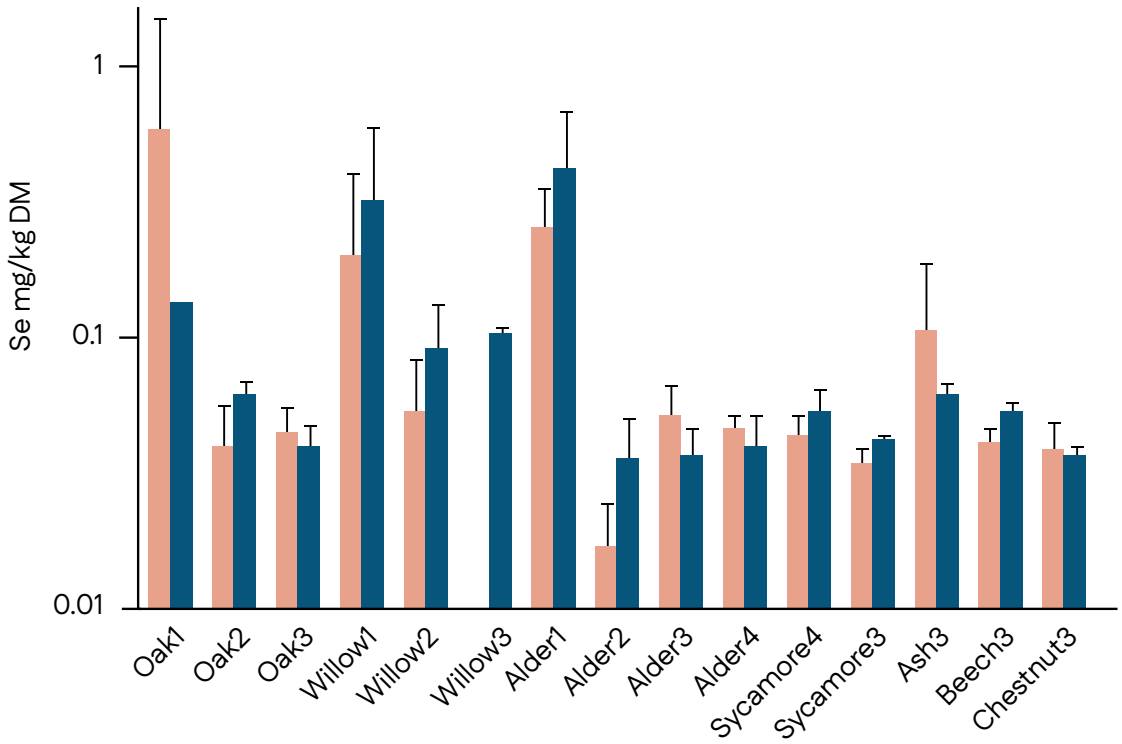
Location was most influential for selenium content which was highest in all species in both seasons at site 1 in Berkshire compared to trees at Site 2 in Leicestershire and at Site 3(4) in Wales (Figure 6). This indicates higher levels of selenium in the soil at site 1.

Figure 6: Levels of selenium in different tree species in June (coral) and September (dark blue) at different sites in England and Wales. (Kendall et al., 2021; Modified.)

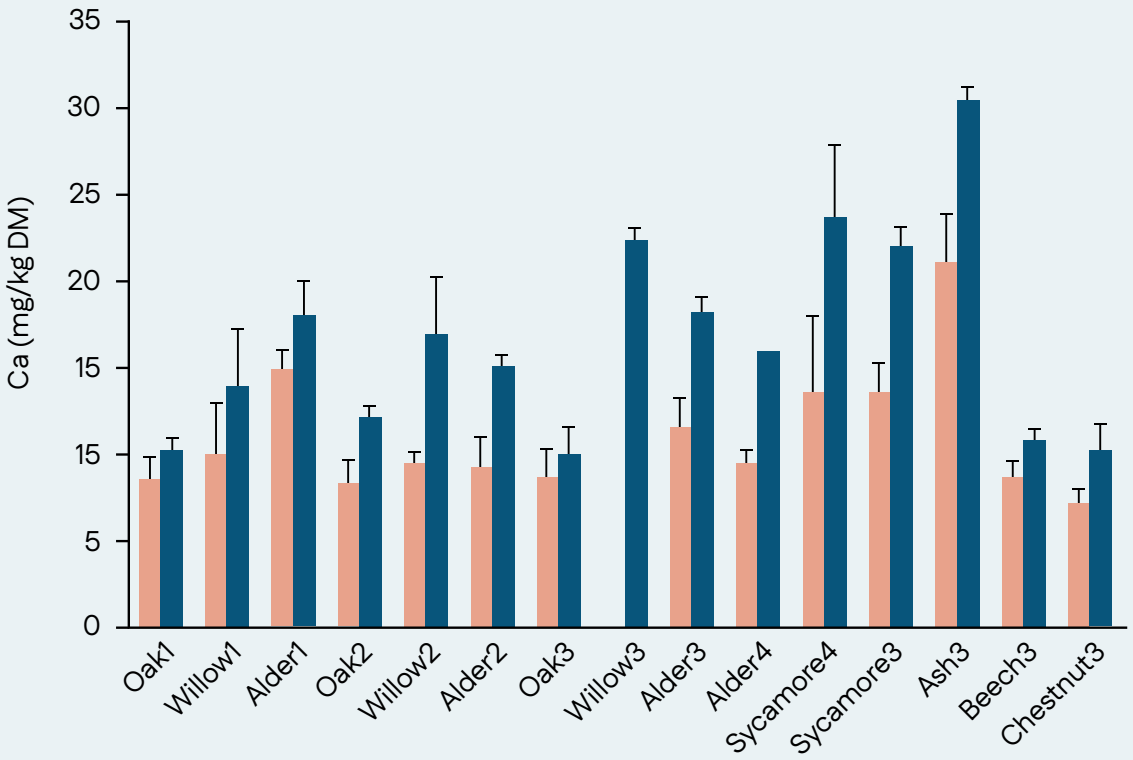


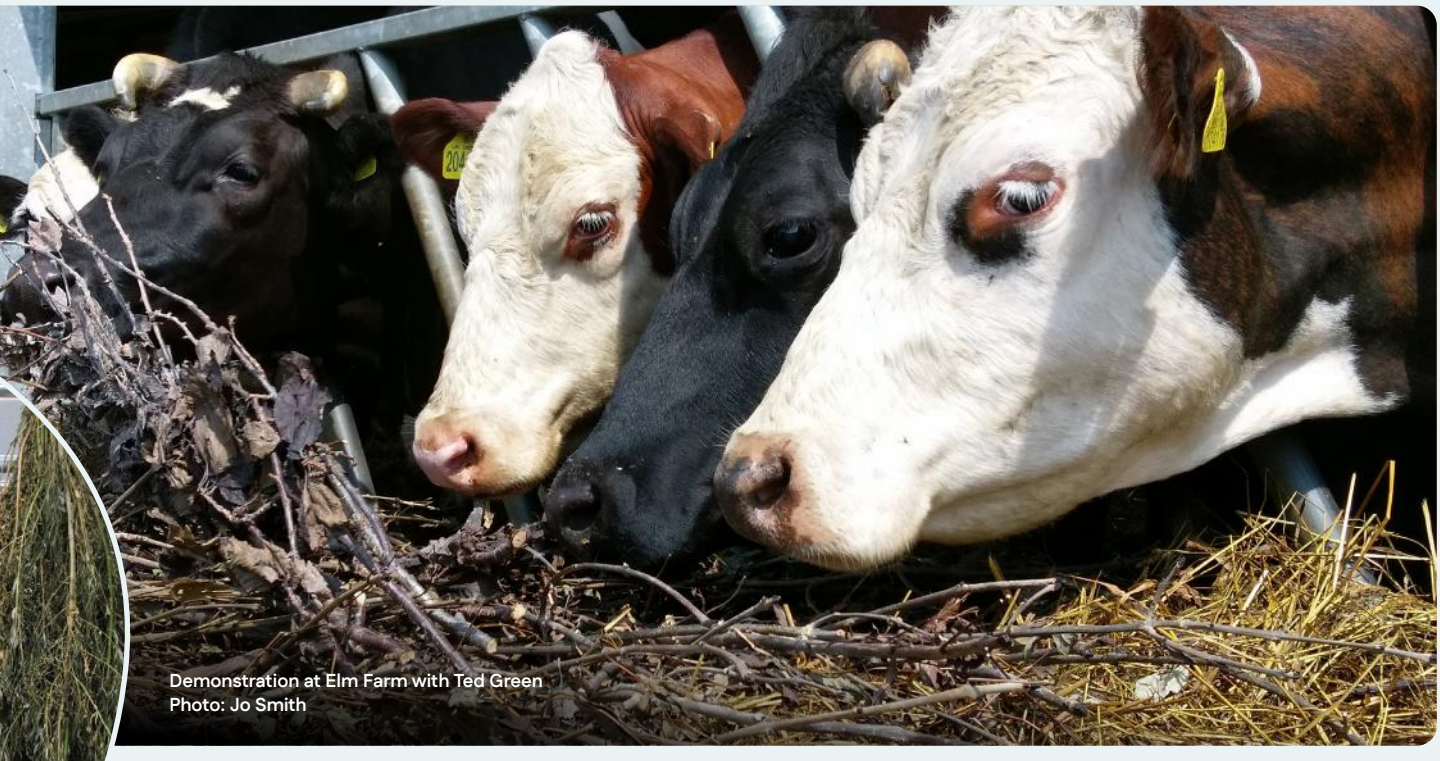
Hazel
Photo: Duncan Elliott

Tree hay
Photo: Lynbreck Croft

Season had the strongest influence on calcium content which was higher in September than June in all species across all sites in the samples (Figure 7).

Figure 7: Levels of calcium in tree species in June (coral) and September (dark blue) at different sites in England and Wales. (Kendall et al., 2021; Modified.)





Demonstration at Elm Farm with Ted Green
Photo: Jo Smith

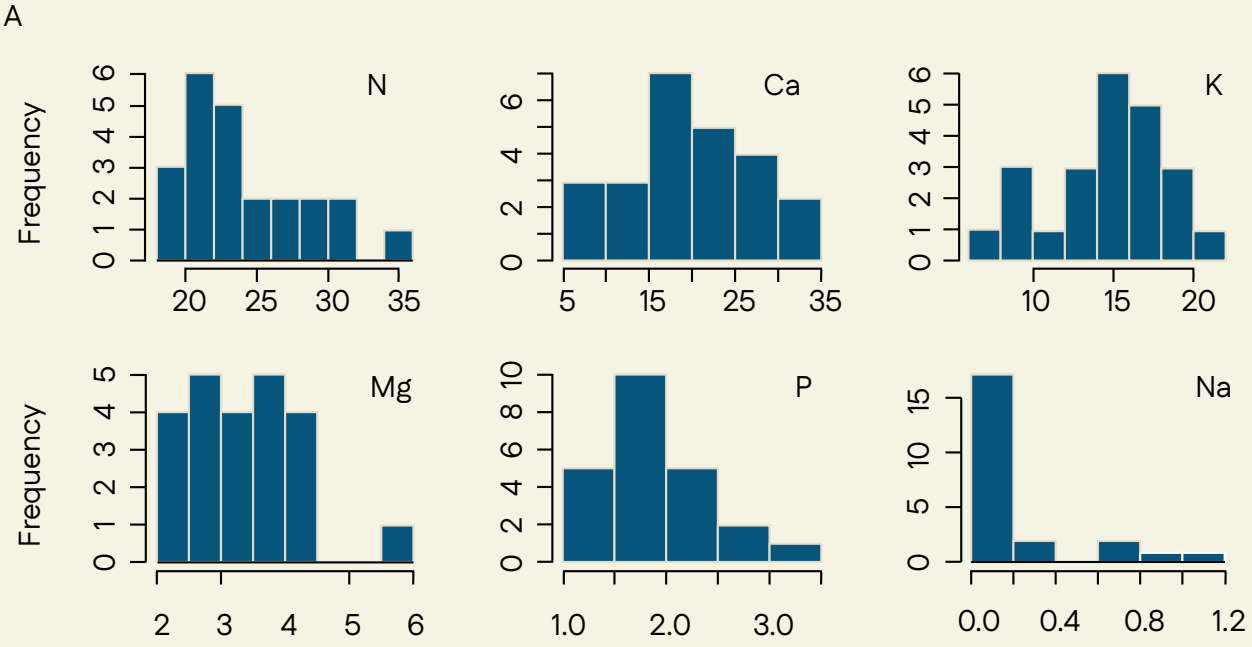
The results indicate some natural variation of mineral content within a single species[23] and further evidence of this comes from a trial looking at mineral content in 35 ash trees (Figure 8), harvested in August from different locations and regions in France, where variable levels were found for all tested minerals.[27] Whilst the increasing number of trials investigating the nutritional value of tree fodder support the wider narrative of the merits of tree fodder in general, trials such as these also indicate the importance of testing on-farm trees to gain better knowledge of actual values present. This is now beginning to happen, especially where external funding is available to support farm-focused research. For example, the TreeFEED project[22] supported the analysis of minerals present in native tree species common in the Cornwall landscape including alder (spp), willow (spp), poplar, hazel, hawthorn and elder. Though mineral content was recorded as parts-per-million or percentages which requires further calculations to be useful as feeding guidance, and comparisons of mineral abundance between species are not linked to animal requirements, the work nevertheless shows how mineral content fluctuates between species and season within this landscape.

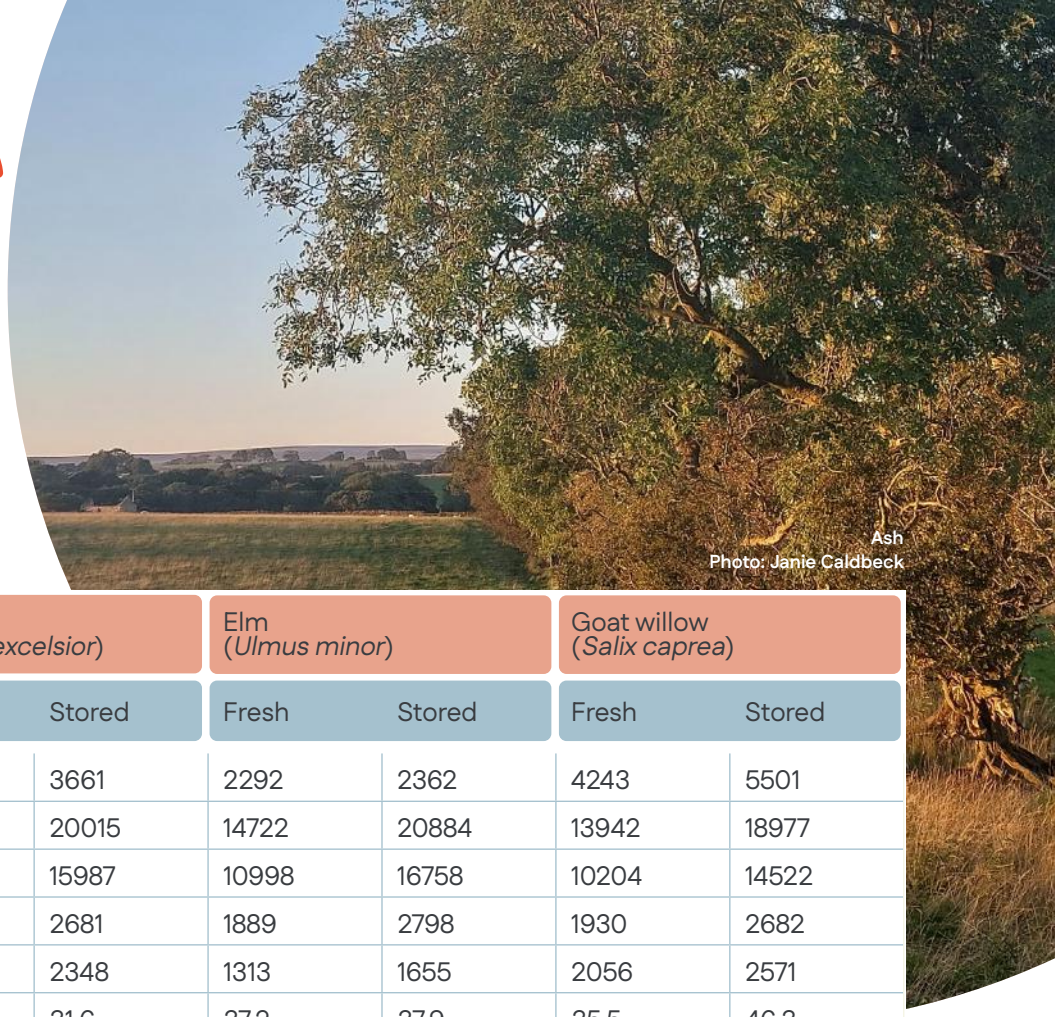
Alongside existing research which indicates that tree fodder is a valuable source of supplementary minerals at the point of harvest, there is also evidence that it is a stable source of minerals after storage.

In a trial looking at the nutritional value of stored tree hay, the leaves of ash, elm and goat willow were collected in July and fed to housed cattle the following March.[43] They were analysed for selected mineral content at the time of harvest and after nine months. The higher levels in the stored samples indicated that whilst other components had deteriorated over time, the mineral content had remained stable (Table 5).

Some species of plants have been researched for their bioremediation potential for harvesting specific minerals (heavy metals) from polluted ground, and the knowledge gained can contribute to the science and practice of harvesting trees as a sustainable source of minerals. Willow species are one of the well-studied bio-accumulator plants and research indicates that mineral content can vary between different plant parts. For example, when looking at the effects of different levels of sewage sludge applied to first-season osier willow and harvested at the end of the growing period in October, though zinc was present in the roots, stems, and bark (Figure 9), the greatest concentration was found in the leaves.[40] Zinc concentration is generally highest in plant leaves during the growing season and moves back into the stems one the leaves begin to senesce. Research looking at mineral content in leaves indicates that zinc levels are highest when harvested in September.[28]

Figure 8: The frequency of distribution of macro minerals (g/kg) in ash leaves from 35 different trees across different sites and regions. (Mahieu et al., 2018; modified).



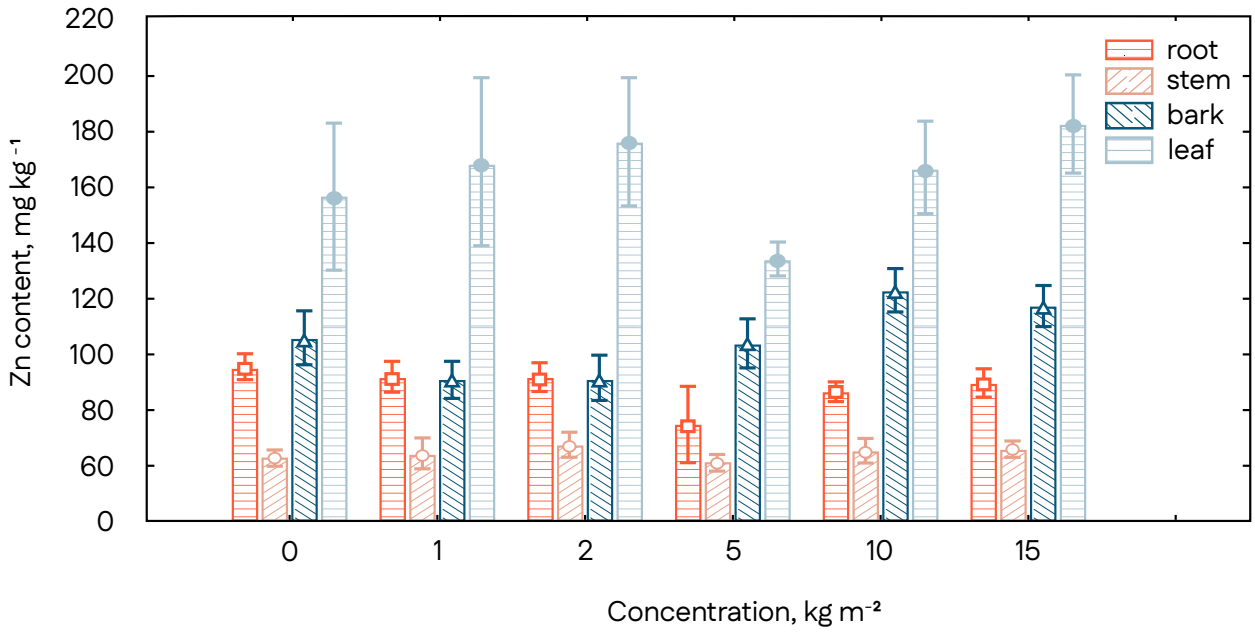


Ash
Photo: Janie Caldbeck

Table 5: Mineral content in ash, elm and goat willow harvested in July and stored for nine months. (Smith et al., 2018, modified.)

Mineral	Ash (*Fraxinus excelsior*)		Elm (*Ulmus minor*)		Goat willow (*Salix caprea*)	
Unit (mg/kg)	Fresh	Stored	Fresh	Stored	Fresh	Stored
Phosphorus	3144	3661	2292	2362	4243	5501
Potassium	14065	20015	14722	20884	13942	18977
Calcium	12776	15987	10998	16758	10204	14522
Magnesium	2235	2681	1889	2798	1930	2682
Sulphur	1840	2348	1313	1655	2056	2571
Manganese	25.5	31.6	37.2	37.9	35.5	46.3
Copper	7.4	9.6	6.5	9.3	7.6	10.9
Zinc	18.5	22.9	31.7	40.1	118	144
Iron	91.2	116	138	258	75.7	142
Boron	15.7	17.5	19.3	26.0	12.7	18.2

Figure 9: zinc content in root, stem, bark and leaf of Salix viminalis treated with different amounts of sewage sludge. There were no significant differences in content between any treatments and the control. (Šaltauskaitė et al., 2017; modified).



In the UK, willow harvested from short-rotation-coppice for biofuel and paper production is typically grown on wetter land which is less suitable for other types of farming and food production. Whilst willow species are well-adapted to growing on wet land, the level of water present may impact nutrient levels if these trees were harvested for fodder, at least in terms of mineral content. Research investigating the ability of various willow clones to bio-accumulate copper and zinc in normal or flooded conditions found that flooding substantially reduced both zinc and copper in above-ground biomass compared to the roots.[59]

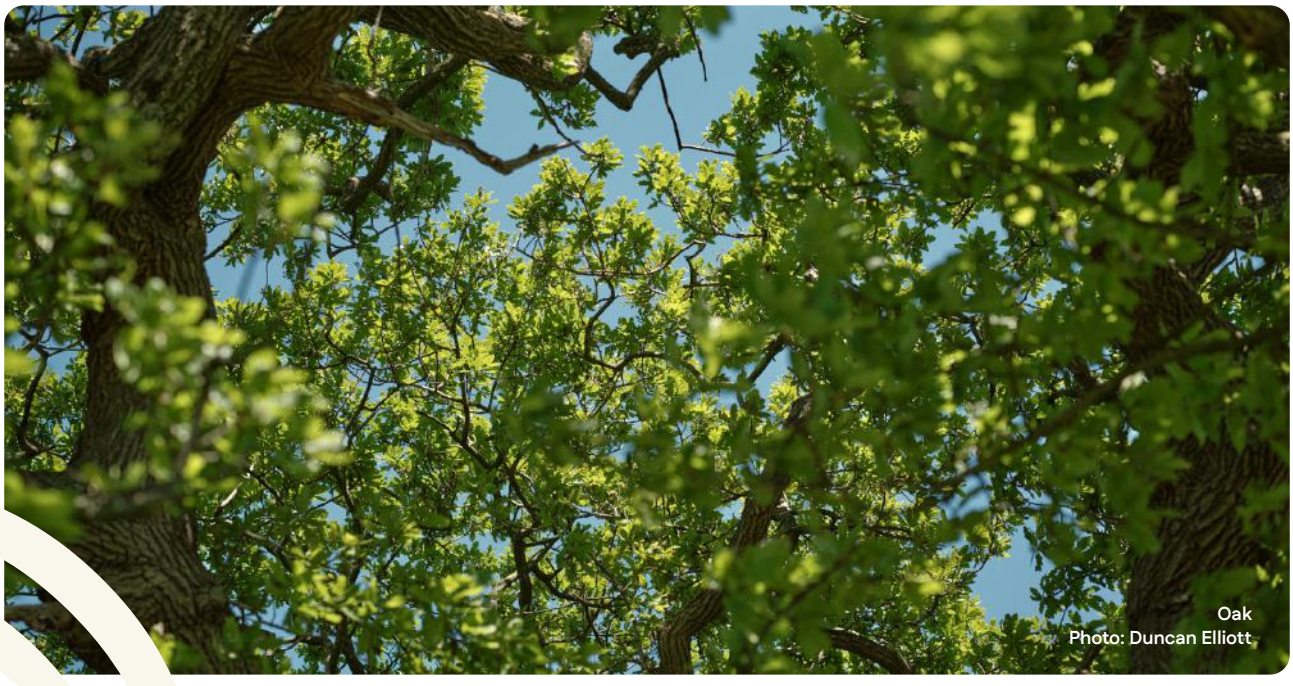
Plant secondary metabolites

Plants produce many different organic compounds which are not considered essential for their immediate survival, and they are collectively termed plant secondary metabolites, or PSMs. So far, over 50,000 PSMs have been identified across the plant kingdom. They are instrumental in plant functions such as growth and reproduction alongside anti-herbivory responses (or anti-nutritional factors), and include the groups tannins, alkaloids, coumarins, flavonoids and poly/phenolic compounds. It is these PSMs which can form the basis of natural and synthesised medicines for both humans and animals. For animal health, two groups currently of particular interest are condensed tannins and salicylic compounds, both of which are present in trees.

Condensed tannins

Condensed tannins (CTs) are part of a plant's arsenal to prevent herbivory. They are bitter in taste and, as a group, can negatively affect carbohydrate fermentation, lipid metabolism and protein breakdown in the rumen.[51] Alongside this, when eaten in higher amounts, they can limit microbial growth so that gut populations are smaller and less diverse.[51,53] When sheep were fed on greater birdsfoot trefoil (*Lotus pedunculatus*) at a concentration of 5.5% CT of dry matter (DM), approximately 60% of the plant's protein passed through the rumen undigested. At 7.5-10% of dry matter intake (DMI), the feeding behaviour of sheep and the digestion of carbohydrates in the rumen were reduced, negatively affecting both body condition and wool growth.[7] When dairy cattle were fed a tannin extract from *Acacia mearnsii*, at only 0.9% DM, their feed intake, protein, carbohydrate digestion and milk yield were all reduced[19] indicating that the source of tannins is also important for outcomes. It is therefore no surprise that historically the presence of any CTs in fodder was unwanted. However, different CTs from different origins, including legumes and trees, are now being investigated for their beneficial effects on protein quality and digestion, medicinal benefits, and for their potential to reduce methane emissions.

Condensed tannins bind to proteins, and these bonds prevent the protein being digested in the



Oak
Photo: Duncan Elliott

Browsing sheep
Photo: Patrick Barbour

rumen. When it reaches the more acidic abomasum however, the bonds are broken and, when fed in moderate quantities (1-4% of total DMI is currently recommended), they can provide animals with a source of high-quality, rumen-bypass protein. In sheep for example, the inclusion of CTs in the diet can increase wool growth, ovulation rate, lambing percentage and milk production.[29] Beneficial levels are not the same for all tanniferous plants since 8.7% tannins (DMI) from sainfoin (*Onobrychis viciifolia*) offers high levels of nutrition for sheep.[48]

There is much to understand still about the structure, potency and ratios of different tannins to help determine appropriate quantities in animal feed. Many sources of tannins (including legumes, food waste products and browse) are currently being investigated,[45,31] including looking at potential effects on methane production, with some promising findings being reported. Steers feeding on willow and grass have been found to emit 27% less methane than those grazing on ryegrass alone.[46] Knowledge of European native and naturalised tree species is growing and recently tested rapid profiling techniques may further increase research in this field.[35] An exotic fodder tree that may be relevant for the UK is the black locust tree (*Robinia pseudoacacia* L.) which, whilst it is being promoted for its timber value and is a recognised fodder tree elsewhere in the world, has low protein digestibility with high levels of faecal nitrogen excretion due to the tannins present.[31]

A higher level of CTs in the diet may also be beneficial when preventing or treating disease. For example, at 5% DM or higher, CTs can prevent frothy bloat in cattle.[25] This amount of CT is greater than the content of most common grasses and legumes in temperate climates, so requires additional plants such as browse to be made available to grazing stock. The presence of plants containing condensed tannins can also help animals to manage intestinal parasite populations, and research into goats and sheep with parasite burdens show an increase in preference for tannin-rich plants when compared to animals treated with anthelmintics. When infected animals were treated, their preference for tannin-rich plants then decreased indicating that the selection of plants was a direct response to the animals' health status.[52]

In a trial where infected sheep were drenched with a tannin extract for seven days, the faecal egg count was half that of untreated control animals after two days, though no further reductions were observed.[2] Lambs that were fed willow as part of their diet for five weeks had significantly reduced worm burdens, including *Haemonchus contortus*, compared to lambs fed only on lucerne.[34] Most of the research to date has been focussed on gastrointestinal nematodes in ruminants though a direct anthelmintic effect from CTs has also been found against the nematode *Ascaris suum* in pigs.[57]

Salicylic compounds

Salicinoids are prevalent in the plant kingdom, with some plants having much higher levels than others. The use of willow bark (and now synthetic salicylates) has a long history in both human and animal medicine predominantly as an anti-inflammatory and pain killer.[38] In plants, salicin is the principal component which when eaten is metabolised into salicylates and then oxidised to salicylic acid (SA) in the liver.[50] Salicylic acid is a precursor of acetylsalicylic acid which is now synthetically produced at scale and better known as aspirin.

Salicylic acid, sodium salicylate and white willow bark are all currently used to treat livestock and have been investigated for their efficacy in treating diseases such as digital dermatitis in dairy cows, mastitis in dairy goats, and inflammation in freshly-calved dairy cows, as well as pain control for castration and disbudding of calves.

There is still limited research on the use of tree fodder as a source of medicine, so it is useful to look at trials testing synthetic salicylates.

As a topical application for diseased hooves, SA (3-5 days treatment) reduced swelling, lameness and body temperature in dairy cows.[37] For cows suffering from digital dermatitis, a weekly treatment of SA gel cured 52 out of 54 cases by day 14 and the remaining two were cured by day 28. Cases were considered to be cured if the lesions were fully healed or the chronic cases became non-active and non-painful.[55] Other research has found that cows treated with SA responded earlier than other tested treatments.[10]

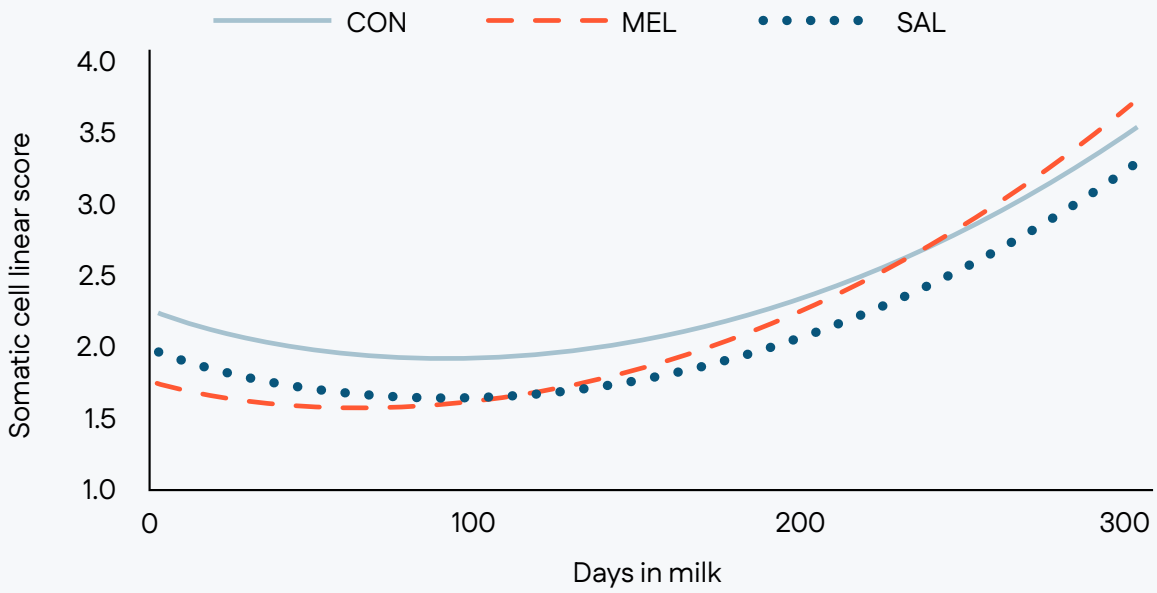
There is much pain associated with the practices of castrating and disbudding. Calves offered SA dissolved in their drinking water had reduced blood cortisol (a stress hormone) and higher average daily weight gain during the recovery period compared to a control group.[6] Commercially available white willow bark given orally has been compared to a synthetic local anaesthetic as pain relief during disbudding. Neither treatment was sufficiently effective and all calves had elevated cortisol levels and disturbed behaviour patterns compared to 'sham' disbudded calves.[4] The willow bark was fed only 20 minutes prior to cautery disbudding, though a separate trial found that peak concentrations of salicylates in blood serum occurred as late as 2-4 hours after ingestion,[18] suggesting that, even if the effective dose was correct, the 20-minute wait was too short. In contrast, late lactation dairy goats that were fed willow (*Salix acmophylla*; 5g/kg DM salicin) at 25% of their daily intake for two weeks had significantly lower somatic cell counts (SCC) compared to control goats.[33]

Drenching dairy cows three times daily with sodium salicylate for three days also had a positive effect on SCC and this positive effect lasted for the whole lactation (Figure 10). The treatment also had a beneficial effect on protein content and milk yield and this impact was greatest in 3+ lactation cows with an increase of 24% in whole lactation yield.[11]

Again, there is much to learn about appropriate forms and quantities of active compounds, methods of administration and rate of absorption, as well as duration of treatments for different diseases (see Phillips et al., 2022[39] and Bacon et al., 2025[4]). Salicylic acid is more aggressive on the mucosal layer of the stomach compared to salicin, and sodium salicylate negatively impacts ruminal activity suggesting that, as an oral medicine, these synthetic versions increase the risk of unwanted side effects, and that salicin from whole plants may be preferable.[32,11] Other polyphenolic compounds present in plants can also contribute to beneficial effects,[17] but known levels of salicin in plants and plant parts will be key to ensuring that any disease and associated pain is treated appropriately. Whilst ensiling willow has no effect on nutritional content, it can substantially alter salicin content, the impacts of which are yet to be fully understood.[31]

Photo: Organic Research Centre

Figure 10: whole lactation somatic cell scores of dairy cows treated with a placebo (CON), sodium salicylate (SAL) or meloxicam (MEL) for three days in early lactation. (Carpenter et al., 2016; modified).



Cattle browsing
Photo: Tim Downes

Ways of feeding/producing tree fodder

Direct browse

The most direct interaction between trees as feed and the animal comes through browsing. Where animals are managed in extensive and low-input systems, the ability to self-select becomes increasingly important for their health and welfare. For example, when grazing poor-quality landscapes such as heathlands, minerals including calcium, magnesium and phosphorus can be in short supply, leading to poor body condition and abnormal feeding behaviour.[54] If there is a variety of species available, animals are better able to make their own choices based on taste, nutritional and medicinal needs and preferences. Placing at least some browsable trees in the animal's landscape brings additional benefits, such as offering shade and shelter.

When offering browse it is necessary to know the browse height for different animals. For cattle this is set at two metres (m), for sheep it is 1.2 m and, as goats are termed 'vertical browsers', there is no height limit set and if they can climb a tree to access browse, they will. Set browse heights should be considered to be maximum heights since feeding at these heights for a prolonged period causes body tension and joint/foot stress. Therefore, if browse is meant to form a meaningful part of the diet, it is worth considering how to make more available where animals can better maintain a more relaxed posture.

Harvested fodder

Where browse is grown for a specific purpose, perhaps as fodder during a drought, branches can be cut and dropped where the animals can browse directly on the fresh fodder. In New Zealand, feeding poplar and willow to cattle and sheep enable animals to better maintain weight and fertility than animals maintained on drought stressed pasture.[30] Trees can be managed either by 'shredding' where the crown height is maintained and side branches are harvested, or by 'pollarding' where the crown is cut at a height which prevents direct browsing (typically at two m) or at a height which suits any machinery required to operate in the same space. Pollarding is the typical method in Britain, though both methods require operators working at height to varying degrees. Cut and drop feeding can also be used where trees are being thinned or managed for other purposes such as firewood, where browsing animals can strip branches ready for further processing. This approach continues an age-old practice, as recorded in a husbandry book from 1534: '*If thou haue any trees to shrede, loppe, or croppe for the fyre-wodde, croppe them… …that thy beastes maye eate the brouse*'.[16] Cut and carry fresh is typically used in systems where smaller numbers of animals are kept with no direct access to tree crops and could be a useful method on modern farms for smaller groups of animals (e.g. breeding bulls or sick animals) which are housed or kept close to the farm.

Elm Farm SRC trials
Photo: Jo Smith


Willows April 2025
Photo: Tim Downes

For preserving tree fodder, edible trees can be successfully dried to make tree hay which is highly palatable for stock. There are various methods which include making faggots (tied bundles), creating covered stacks outdoors, or loose-lying branches placed on flatbed trailers to dry undercover with a reasonable airflow and out of direct sunlight. Good airflow and cover from sunlight are important to prevent mould and to help stop leaves becoming brittle. Harvesting in dry weather will also help. In terms of management, a further consideration is the level of waste created if branches are harvested bigger than that which the animals are willing to eat or gain nutritional benefit from. For mixed systems, these bigger stems could allow for some bark stripping which may offer further nutrition as well as act as meaningful environmental enrichment for stock such as goats and pigs.

Where supplies are limited, tree hay may be a useful supplement in smaller quantities for all livestock with a focus on specific nutrients (e.g., as a mineral supplement) or fed to a few livestock in specific circumstances. This may include a willow species high in SA (such as goat willow) being fed preferentially to sick or breeding animals at lambing or calving time - where the anti-inflammatory properties can promote self-medication and support pain relief.

Silage can successfully be made from tree fodder and some zoos are well-practised in producing silage to provide environmental enrichment for their hooved mammals. Research trials on the value of tree silage for stock animals were already being carried out in the seventies,[41] though the focus was on the provision of fodder for range-managed beef cows, and the whole (poplar) tree rather than just the more nutritious leaves and twigs was harvested. More recently, with a growing interest in alternative uses for short-rotation coppices beyond biofuel, and with improving mechanisation capabilities for harvesting coppiced crops, there is potential for tree fodder silage to become a meaningful component of livestock diets. An over-reliance on producing tree-fodder with this approach however may limit the number of tree species being utilised and therefore limit the benefits to the animal in terms of diversity, nutrient availability and access to the many plant secondary metabolites which can provide medicinal benefits.

Our two contrasting case studies bring some of the practices described to life; detailing practicalities that need consideration, challenges, and some of the many benefits that can come from having tree fodder as a supplementary feed, positively impacting your animals' health and welfare and your farm business...

Photo: Lynn Cassells

Case study:

Lynn Cassells at Lynbreck Croft

Lynn Cassells and Sandra Baer farm Lynbreck Croft - a 59-hectare (ha) landholding located in the Cairngorms National Park in the Scottish Highlands, comprising of in-bye fields, rough grazing of mainly heather moorland, and woodland. They have a fold of Highland Cattle, rare breed Oxford Sandy and Black pigs, free-ranging pasture laying hens, and honeybees. They run an adaptive multi-paddock grazing system where in the growing season the cattle are moved, mostly daily, into new paddocks.

Extreme weather is not unusual - they have experienced up to a metre of snow and severe drifting in the winter, and droughts in the summer, which are predicted to increase with climate change. In this context, incorporating trees in every aspect of what they do has been critical. Originally shelter was a big focus. In a goal to maintain and increase the health of the woodlands, they have been thinning and replanting different species and have extended and connected existing woodlands and planted hedging (largely hawthorn with hazel, blackthorn, holly and dog rose) across the croft. They planted a willow hedgerow in a particularly wet area in the hope it will be browse as well as shelter for the animals in the future. They have also densely planted 10 copses of primarily alder, willow, and rowan, on marginal/unimproved land (with a lot of self-seeded birch), to be harvested as tree hay crops.

Why tree hay (fodder)?

We became aware of tree hay when we were in the south of England working for the National Trust, and I was spending a lot of time with a group called the Ancient Tree Forum, which was started by Ted Green. Ted used to talk about ancient pollards and the benefits of feeding tree hay to livestock in the winter and how it was something that was practised traditionally.

It came into my mind again when we moved to Lynbreck and we started to graze our Highland cattle in our fields. I watched them one day browsing on a tree and started to wonder why they were focusing on tree leaves rather than the grass beneath? Through various explorations and conversations, I realised it was because there was nutrition in tree leaves they were looking to access. I investigated things a bit more, which included making contact with Lindsay Whistance, and learned about the percentage of tree fodder that livestock (cattle particularly) will take from trees, if given the opportunity.

We'd always believed in having the right animals to suit our land and in having as much biodiversity in the land for the animals to access the nutrition they need. Through our adaptive multi-paddock grazing system, we have begun to increase diversity in our pastures, which in turn is providing our cattle with a rich buffet of different plants and all they have to offer. In addition, regular access to a range of tree species acts as a source of supplemental nutrition.

In winter we buy our hay in so we're not always 100% sure of its diversity and nutritional value, so we decided to copy what the cattle would naturally seek out in summer and thus make tree leaves available to them in dried form.

Lynbreck is about 59 ha and about 3 ha is existing woodland. We've planted lots more as we try to expand existing woodland cover, but in the early days we didn't have much access to trees that we could be felling or harvesting tree hay from. So, we've been largely doing two things; in early to mid-summer we thin some naturally regenerating areas out and gather branches with leaves to dry into tree hay, and we manage the 10 copses we planted on a 5-year rotation, where every year we aim to harvest two copses as livestock feed.

Cattle eating tree hay
Photo: Lynn Cassells

Sandra pollarding alder in our tree hay copses
Photo: Lynn Cassells

The tree hay helps give our animals a boost of nutrition and medicinal compounds in the winter that they're not getting from their grass hay.

We don't routinely worm our cattle and instead monitor worm burdens through Faecal Egg Counts. So far, in the 8 years we've been keeping cattle, we've never had to de-worm them and we put that down to our grazing system and the diversity of what they eat, being able to access natural anthelmintics when they require them. In addition to letting the cattle self-medicate in that way, we have the advantage of not having to use chemical anti-parasitics which would massively harm the soil biology in our pastures.

Ideal times to harvest and how

Sandra and I are completely self-taught at this. We go by what makes sense. Just as one does for grass hay harvests, we aim for tree hay harvest to coincide with the peak nutrition point in leaves. So, in our climate this will generally happen late June and through July, however we allow for a window of opportunity into August to fit in with our workload. In terms of weather conditions, we always aim for a dry day so as not to be bundling wet branches. We harvest as much as we can (birch, willow, alder, rowan, ash) from a chosen area and we'll do it in one of two ways – in areas to be thinned we fell the whole tree and then trim the branches off and bundle the tree hay, and in the copses we've specifically planted, we are experimenting with pollarding the leading tree stems.

We cut them at about 1.80 to 2 m, aiming for it to be above browse height - we have red deer, so the browse height is quite high. We only pollard trees that have growth above and beneath that point. We are having to learn how quickly the rotations grow back. Some of the trees that we were wanting to harvest from one of our plots had grown too tall with no green growth below the cutting point, so we left them and waited until the winter to pollard them, in the hope that they will then sprout the next year. What we're trying to establish through trial is how to establish a living pollard rotation.

Storing and feeding

We dry the tree hay in bundles hanging in rows along the walls of our open fronted barn which allows for plenty of air circulation. When we harvest, we bundle as many branches as we can physically grasp in our hands, tighten it using reusable cable ties, and then hang it to dry. After harvesting the majority in late June and July, we then start to feed that out when we begin to feed our cows hay - which can be anytime from late November onwards.

We experimented with how to feed it - including throwing it down on the ground in the winter, but this wasn't ideal as the cows couldn't wrap their tongues round and rip the leaves off. We decided to tie the bundles to fences; the animals then have something to pull or tug on. They'll work away at it through the day until we are just left with twigs.

We don't yet produce enough tree hay to match what our cattle would eat naturally but each year the goal is to try and harvest a little bit more. As we get our pollard plots going and natural regeneration becomes more abundant around the croft, we should be able to up our production. I always have a figure in my head (it is from a Forestry Commission document that Lindsay Whistance often refers to), which is 12% of a cow's diet will be from tree leaves - and in certain situations it can be up to 55%, so there is definitely potential to increase availability to enable the animals to access the nutrition they are after.

But what we have observed is that our cattle are always exceptionally interested in the tree hay bundles when we put them out, and in some situations, they will even eat some of the woodier material of the branches. There are some species that they seem to prefer over others. We've noticed this winter how the dried alder in particular is very popular, it's a species we were told might not be all that palatable, but it's obviously filling a nutritional or medicinal gap.

We have also observed how new young stock, never having been exposed to tree hay before, will copy older animals and try it for the first time. Interestingly, they will generally not eat much during that first session but will show much more enthusiasm as quicky as the second feeding, confirming the theory of responding to nutritional feedback.

Historically, there are reports of farmers feeding cattle tree leaves in the winter, and as we grow in knowledge and experience, I'm 100% convinced that the harvesting and feeding of naturally available tree hay is a key opportunity for a holistic farming and crofting system.

The tree hay hanging in our barn to dry
Photo: Lynn Cassells

Photo: Janie Caldbeck

Case study:

Tim Downes, at The Farm, Longnor

Tim Downes runs an organic dairy and beef farm at The Farm, Longnor, south of Shrewsbury in Shropshire. Within 405-ha, he planted 2.5 ha with in-field trees, with the intention of benefitting livestock health and welfare and improving farm outputs. He was interested in fodder-based nutrition for his herd, exploring the potential nutritional and medicinal benefits available from trees.

He planted three mixed species rows of 300 sycamore, hornbeam, small-leaved lime and elm trees in one field in 2014 to particularly provide nutritional value, and rows of 300 Salix species including crack willow and white willow in two other fields in 2015, with a view to them providing potential medicinal value.

Other fields on the farm are mainly open grass pasture; some contain old lone oak trees and have field corners planted with trees such as cherries and silver birches. Established hedgerows (comprising predominantly blackthorn and hawthorn) surround most fields and are managed on a 2 -3 year cutting rotation with the intention particularly of providing good habitat for birds and invertebrates. The dairy herd are mob-grazed outdoors from mid-February to October and are moved to new pasture every 2-3 days. Grass is also cut for silage to provide fodder during the winter.

Tree choices for the in-field tree trials

With help from Helen Chesshire from the Woodland Trust, Tim Saunders researched the nutritional and medicinal value of trees in a dairy system and designed the field trials as part of his Master's in Research at Harper Adams University. After he had done his literature review of what trees we should be planting, we then looked at making sure that we stayed within the native tree criteria, because the Woodland Trust would only fund native species... Tree choice for both trials were determined by selecting palatable species using anecdotal evidence and evidence from published work. The trees needed to be native, productive, resilient, quick growing and non-poisonous.

Planting designs and observations

The original design had a randomised planting scheme of set squares so that we could look at which trees the animals preferred to browse... But since then, when trees have died, the Woodland Trust have provided us with replacements, so we have in-filled any gaps and there is no longer a set, randomised pattern. I think most of the failures have come from animals knocking them down when the trees haven't quite rooted enough...

Photo: Janie Caldbeck

Cows enjoying the field with trees for nutritional value in May 2018
Photo: Tim Downes

Mixed species rows in June 2021
Photo: Tim Downes

Cut back willow
Photo: Janie Caldbeck

Bull in willow field
Photo: Tim Downes

"I would probably plant the willows a bit closer now and create more of a hedge-like structure because the animals don't walk in-between them."

The spacing around the hornbeam and small leaf limes is probably a little narrow (about 4 m wide), we can drive a tractor down, but it ideally needs to be at least 6 m wide to get machines down comfortably. Planting north-south works better than east-west - I've learned over the years that it is better for sun travel and shade, for the animals, and for tree growth.

We planted a lot based on suitability for our soil type and based on wanting to create an environment where we can, every now and again, harvest the willow trees for the cows as fodder, and when they get too big, cut them back to a 4 or 5-feet high...

I would probably plant the willows a bit closer now and create more of a hedge-like structure because the animals don't walk in-between them. Research also suggests that trees support one another through the mycorrhizal bacteria in the soil - another advantage of planting them closer...

The cattle respect an electric wire that's about a metre away from the boundary of the willows, but they'll still browse over it if they feel the need... We are coming round to the idea that we need to fence the trees off more permanently to protect them from the bulls. They offered outwintering potential - we're on some fairly heavy clay here, so the ground can get poached quite easily. We didn't have any housing at the time of planting because of the loss of a shed in a fire, so the bulls stayed out a bit longer and damaged quite a few of the trees. We now need to look at what we need to do to replace those. Finding enough time and labour to help me to plant more is key.

Breeds and ability to browse

We have a mixed cross breed of predominantly Irish Friesians. The red and whites within the herd are Norwegian Reds and Fleckviehs, with a few Shorthorns thrown in for good measure. If you released a herd that had been fully housed all their life expecting them to browse and graze through all weathers or all conditions, it would not work as successfully as the herd of animals we've developed. You could call it a little bit like hefting for sheep, making sure that they understand where they've got to be when, and what species they can and can't browse.

Grazing versus browsing

Cows can graze 90% of their intake (40 kilos (kg) of fresh weight or 12 kg of dry matter) within 3 hours. When ours go into a new paddock, they'll often graze the grass, then a couple of hours later, they'll be busy browsing. I think they find the browsing useful for their gut and digestion, adding different tannins and flavours. They probably browse more when it's dry, rather than on a horrible wet day – when they will stand underneath the leaves and get some weather protection. We tend to return them back to the paddock after milking around 8 or 9 am, and then again around midday. In grass, the sugar levels are higher in the afternoon than in the morning, so I wonder if that's the same for trees, because photosynthesis is happening, bringing up more nutrients from below... It's perhaps something worth looking out for – to ascertain whether there is a certain time of the day they'd favour to browse.

Browsing
Photo: Tim Downes

I don't think I could distinguish between the different Salix species for animal preference - they go for them equally. Some of the leaves look more palatable than others to me, and different coloured stems come through as well - bright yellow, dark green, a hint of red in some of them - we have an amalgamation of different species, so hybridisation has occurred I think. I think the animals prefer those that provide a more drooping habit, they can get to the leaves a bit more easily. Those that grow straight up quickly soon get out of reach. They do browse a lot from the hedgerows as well - I see them navigating towards hazel, ivy, anything that is tasty to them. They will browse for cobalt, copper, iodine, all sorts of different minerals... as observed through samples that we've taken.

They browse woody material as well as leaves - they like the bark which can be a bit of an issue. There are teeth marks on sycamore trees!

All the willows are subject to some bark removal. I think there are high levels of salicylic acid in the bark, as well as the leaf material. I don't think there's much in the actual lignin and timber, but there is in the bark. They browse the leaves and then if I've taken the wires down, they will browse and take off the bark, which doesn't help the trees. We don't have huge numbers of deer around here, but we need to protect from the likes of hares. This year we saw about 10 - 12 hares in one field.

Regarding the diameter of willow stems, I have noticed that they will browse some quite seriously chunky sizes - up to 2 cm in diameter. I think I probably gave them too much all in one go when I chopped it all back over the course of two days. They came in and browsed it, walking in amongst it. I wouldn't know the amount each individual animal ate, but they all navigated towards it, it was offering different flavours, different benefits...

Health and medicinal benefits of browsing, and impacts on milk

Because the willows are closer to the dairy, any animals that need any TLC (for example having difficulty calving, or mastitis or lameness), are put in those paddocks to make sure that they have access to the willows on a rotational basis. The browse is providing nutritional and health benefits, but I wouldn't say it's providing a large percentage of their total feed. I've got video evidence of cows browsing but haven't analysed which cow goes for which species according to what ailment they're suffering from.

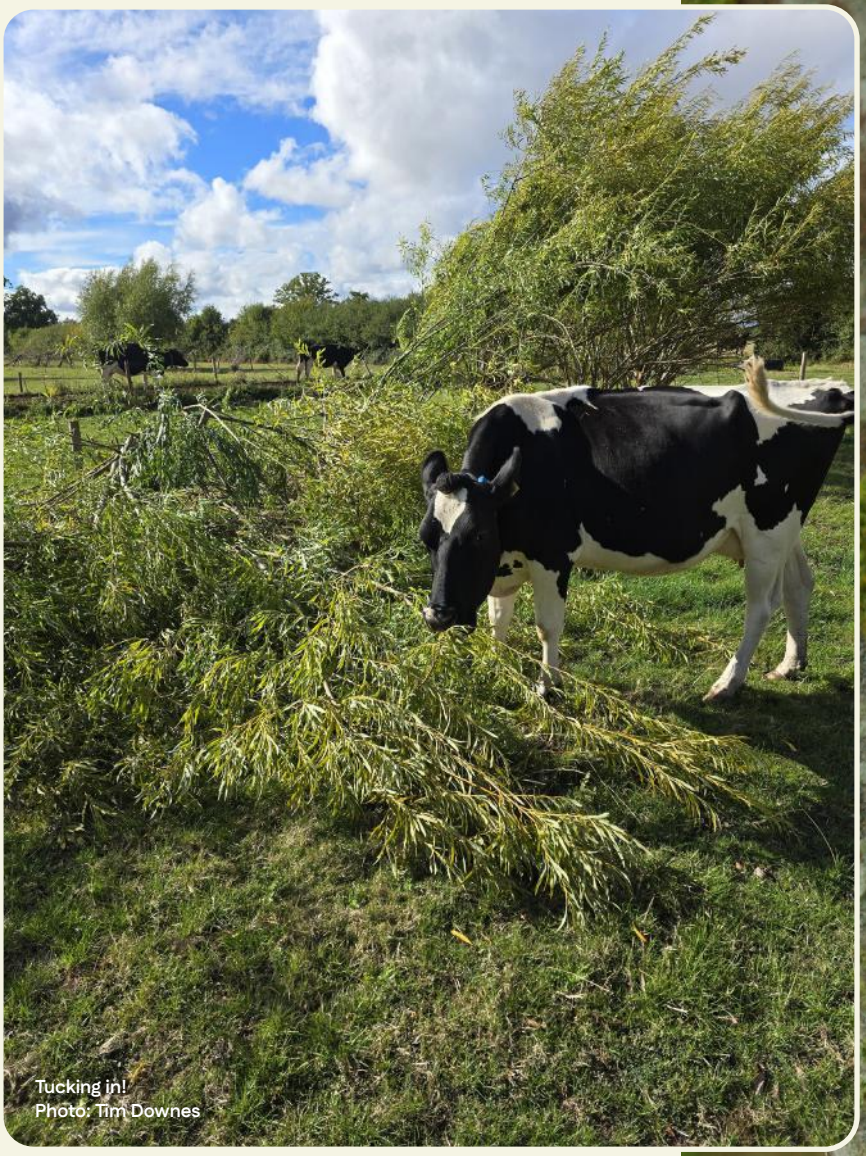
Our mastitis levels are currently very good. We get a few cows with sore feet because they do a lot of walking here (2 - 4 times a day to different grazing areas, and then back to the milking parlour). With any cows that don't want to walk to the far end of the farm (nearly a mile away), we will give them a shorter walk into the paddocks with the willow trees in. It also provides them with shelter and shade in the summer. We're getting hotter, drier summers, possibly wetter winters..., so we're also trying to pre-empt some of these environmental challenges.

Our potential number of lactations is significantly higher than the average, this could be due to a lot of reasons - different feed, different focus... but the agroforestry/silvopasture plays a part in creating healthy stock that don't tend to leave the farm.

We test the milk monthly, and know what the amino acid levels are, milk fat, protein, yield, cell count... I wouldn't say browsing has had any negative effects. It would be useful to know whether some of the animals that spend more time with the willow trees have any different milk composition to the others.

Our fertility has been excellent in the cows. We've had cows in calf that we didn't think we were going to get in calf - in a short service period as well. We're block calving 300 cows, and we self-select any animals that we don't want to continue with the herd for various reasons... The fact that the majority of cows have been good to get in calf shows their energy is there and they respond well to feed (we're giving them a rising plane of nutrition).

Bark removal



Tucking in!
Photo: Tim Downes

Photo: Janie Caldbeck

Photo: Janie Caldbeck

The cows get a lot of benefits from rubbing - general blood flow to the skin is increased when they rub against a tree. They enjoy walking and weaving their way through them and any bit of back scratching is a bonus!

Cows enjoying the different benefits the trees can bring
Photo: Tim Downes

Certainly, our longevity of cows has improved over the years - whether that's changing management, breeding, season, staff... all sorts of different things come into play...The happiness of cows is also important and impacted by them being more comfortable being milked. They have shade and shelter from walnut trees around the milk collecting yard, preventing the cold or hot winds, and walnuts also help to reduce the fly problem, they give off a pheromone that reduces flies. We do have fans in the parlour that keep the worst flies away, and the rest seems to work very effectively.

Giving the cattle access to willow trees with tannins in should help alleviate clover bloat issues. We had some rye grass and clover bloat in 2025 for the first time in about 20 years, and I put that down to having had such a dry summer - nothing grew as successfully because we had no rain, and all of the nutrients built up over the summer, with cow dung and urine on the pasture as well. Then rain in September, October, and November meant the grass grew so fast that the animals struggled to graze it. The nutrient density was good – we got tests of 24% protein, 12% ME, 17% dry matter... Trying to get the feed intake into them without them swelling was a challenge, hence the bloat cases. Having access to trees would have been beneficial in some of the paddocks which were just full of clover and rye grass.

The cows get a lot of benefits from rubbing - general blood flow to the skin is increased when they rub against a tree. They enjoy walking and weaving their way through them and any bit of back scratching is a bonus!

Tree fodder

We have given them tree fodder, but my intention was that we could do it with as little storage as possible for the wintertime. Our main winter feeds are stored rye grass and clover. We farm organically, so finding alternative feeds can be challenging. Five years after the willows were planted, we decided to cut it and store some on trailers (on pallets), dried it out, then put it through a chipper and fed it back to the cattle.

They ate all of it up so it must have been tasty. What came out of the chipper was up to about an inch in size. There were no negative effects of putting it through a chipper.

The tree fodder was cut in October, then we stored it in sheds until December when it had thoroughly dried out. It still had a green tinge to it, but the leaves were more friable, and if you touched them, they would break up.

Some of them had enough body to be able to tear off like a leaf. Then we borrowed a neighbour's chipper and chipped them into a bucket on the front of a loader and sprinkled it on top of the silage for the cows. It was unscientific, but the fact that the animals ate it, enjoyed it, and there were no detrimental effects was good... they must have been able to get more calcium and minerals from the willow, and hopefully some salicylic acid benefits as well.

Cows enjoying the willows
Photo: Tim Downes

Silage trial

We did experiment with silage a little - we wondered whether we could get a machine that would chop branches off, then we'd gather it in, put it within the silage pit to ensile in an acidic environment, and see whether the cows would nibble it out as we went. I think chipping would be better - there is more surface area for the lactobacillus bugs to work on, rather than leaving it as long lengths of timber and ending up with willow trees growing in every nook and cranny around the farmyard. That was the problem when we first started to feed it to them - we were feeding the long lengths of stem and branch, and the cows were not eating it as well as when it was chipped. We ended up with silage being eaten, and lots of twigs and branches left everywhere.

Having to chip however is another job when we're busy silaging. We could put it through the silage wagon, but whether the silage wagon would chop it up enough, I don't know... Not getting any soil or muck contamination in the silage pit would be critical. We put small bits in - a few branches, not whole trailer loads. We had six drays (6 m x 4 m x 4 m) loaded full of branches. The first time we did it, that was all chipped. It eventually reduces to quite a small size, but when you have a large quantity of branches to deal with it can be hard to handle.

Management of the trees

Management is generally as hands off as possible. I think once they've got to a big enough size, the trees do look after themselves. The only problem then is if they haven't rooted in well enough and they're pushed over.

The trees planted more for nutritional purposes have been left to their own devices to grow and haven't been trimmed at all, apart from through browsing, and some of them have grown quite tall, over and above browsing height, which has created more of a woodland effect. Perhaps we need to chop them back a bit so they're more browsing height... but I do think we'd lose some of the benefits obtained from shade and shelter and it could potentially weaken a tree and encourage disease.

I'd love to plant more, but it's what and where and how they would integrate with our grazing farming practices at the moment. Spreading dirty water with an umbilical system with lots of rows of trees might be a bit awkward, and when we're topping or pre-mowing areas of grass for the cows to graze, we need to be able to get round the trees and not plant dead ends.

Biodiversity benefits from trees that impact on cattle health

A study that has been carried out on the farm by Katty Baird, Imogen Ryan and Alice Broome, (of Forest Research) to investigate whether rows of willow trees in pasture fields enhance biodiversity on an intensive dairy farm, includes reference to willows being fast-growing trees that support a high variety of native biodiversity, in particular leaf-feeding invertebrates and lichens.

> The browsed trees attract birds and aphids, and we get a lot more wasps, hornets, and bees. All will be beneficial... wasps keep fly numbers down.

We've stopped using the tiny parasitic wasps (supplied in rice bags from America) - we would distribute them around the composted manure piles, anywhere where flies could perhaps create a supply of maggots, because the parasitic wasps put their larvae within the maggot, and then they multiplied... But having more trees and more shade has meant we no longer have to do this.

Willows - August 2024
Photo: Tim Downes

White and crack willow
Photo: Tim Downes

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Further information

To explore the topics in this guide further, head to the Agricology website and the Tree Fodder Hub, which pulls together a wide range of videos, webinars, tools and guides for further study at your leisure.

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