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Timing of leafy branch harvest for livestock satisfaction and tree health

Le fourrage ligneux : principes de gestion pour une bonne qualité alimentaire et une ressource

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Abstract

Soil fertility, weather (including pollution), species specific traits, and individual tree history affect tree carbohydrate stocking, and tree antifeedant chemical responses (Fox and Mickler, 1996; Kays and Canham, 1991; Harborne, 1991). These in turn affect livestock response to fodder from pollards. Also, carbohydrate storage is necessary for trees to re-sprout successfully. So observation and animal consultation are critical in choosing best harvest times per species and on a tree-by-tree basis, each season. A diary of dated livestock choices is a helpful site- and herd-specific guide to seasonal nutritional windows for each tree species, yet with changing conditions, dates vary. One should always offer samples to animals (or taste oneself!) before cutting a lot. Livestock can consume a higher quantity of tree matter when they also have grass or grass hay (Papanastasis et al., 2008), and/or when offered a broad array of tree and plant species to balance against each other. Ensiling (fermenting anaerobically, traditional for hogs and cattle, Maschatchek 2002) or heating dried leaves (traditionally in water, also for hogs and cattle, Slotte, 2000) can alternatively solve antifeedant issues, which are especially an issue if trees are stressed. Pelletizing may possibly be a modern solution (Walder, 2017). Live soil, well-fed by trees and animals, reduces tree stress and broadens harvest windows. Intestinal microbes of livestock must shift to deal with some fodders, and naturally tend to shift with seasons (Ulrey et al., 1964). Historically, sheaves of leafy twigs were stored extensively in beautiful outdoor racks and stacks (Slotte, 2000), to overwinter livestock. A barn loft or a tarp also work. I am excited about this rise of interest in a very beneficial tree – farmer – livestock ecology. I hope that you find my experiences and studies to be of use.

Résumé

La fertilité des sols, les conditions météorologiques (y compris la pollution), les caractéristiques spécifiques des espèces et les antécédents individuels des arbres affectent leur stockage d'hydrates de carbone et les réactions chimiques des composés non digestibles (Fox et Mickler, 1996; Kays et Canham, 1991; Harborne, 1991). Celles-ci affectent à leur tour les réactions du bétail au fourrage des trognes. En outre, le stockage de ces hydrates de carbone est nécessaire pour que les arbres puissent repousser avec succès. L'observation et la consultation des animaux sont donc essentielles pour choisir les meilleures périodes de récolte par espèce et par arbre, selon chaque saison. Un journal des choix du bétail datés est un guide utile, spécifique au site et au troupeau, pour les fenêtres nutritionnelles saisonnières pour chaque espèce d'arbre, même si les conditions sont changeantes et que les dates varient. Il est nécessaire de toujours offrir des échantillons aux animaux (ou goûter soi-même!) avant de couper une grande partie des feuillages. Le bétail peut consommer une plus grande variété d'espèces et une plus grande quantité de matière lorsque cette ration est complétée avec du foin ou de l'herbe (Papanastasis et al., 2008). L'ensemencement (fermentation anaérobie, traditionnelle pour les porcs et les bovins, Maschatchek 2002) ou le chauffage des feuilles séchées (traditionnellement dans l'eau, également pour les porcs et les bovins, Slotte, 2000) peuvent également résoudre les problèmes liés aux composés non-digestibles. La granulation peut également être une solution. (Walder, 2017). Le sol vivant, bien nourri par les arbres et les animaux, réduit le stress des arbres et élargit les fenêtres de récolte. Les microbes intestinaux du bétail doivent évoluer pour faire face à certains fourrages et ont naturellement tendance à évoluer avec les saisons (Ulrey et al., 1964). Certaines feuilles refusées en été peuvent devenir des fourrages séchés en hiver. Historiquement, les feuilles séchées étaient largement stockées dans de superbes casiers et cheminées en plein air (Slotte, 2000), afin d'hiverner le bétail. Un grenier de grange fonctionne également.



(Fig.1) Goats devouring newly leafed beech, 2016

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After spring leaf-out, deciduous trees strive to store carbohydrates, reaching a plateau of full storage in mid- to late summer, with dates varying by species and weather (Kays and Canham, 1991). When roots, trunks and limbs are fully stocked, leafy branches can be taken without harm to the tree, and with most carbohydrate benefit to the animals.

2011 through 2014 my Saanen dairy goats chose tree preferences at consistent calendar dates; I observed and recorded their choices on browse walks, and their responses to pruned leafy branch offerings. Later an American Guinea Hog sow joined us. Beech was favored for fresh eating in early spring (Fig.1), with a less exciting fall window more valued if dried for winter; white birch in later spring, yellow birch longer; ash, elm, basswood, locust, willow, cherry, apple, pear, peach, plum, silver and striped maple all endlessly delicious including dried leaves and fresh winter bark; oak and aspens especially in late fall when other leaves have turned; red and sugar maple fresh bark or dried leaves in winter; softwoods also in winter, with white cedar, Norway spruce, and hemlock usually most popular in that order.

Droughts in summers 2016 and 2017 made optimal timing of harvests less clear. Leaf coverage varied; looking up, blue sky was visible through some thin canopies of stressed trees. Insect damage or diseased leaves signaled a weakened state of others. The goats at times refused favorite species. Less grass was available for the goats to balance tannins and other antifeedant tree chemicals (Papanastasis et al., 2008) and the trees were producing more of these chemicals due to stress (Harborne, 1991). The grass and other plants also can become less edible from drought stress. Some ash trees were unable to fully leaf out, let alone re-stock carbohydrates. Sometimes I pruned anyway, as the false dormancy thus created might relieve the tree from drying out. I gave the goats long walks to find a diversity of plants for dietary balance.

Historically temperate tree leaf harvest times varied as much as a month from year to year due to weather and moon phases (Carlsson, 1996). Farmers in Sweden used to taste the leaves to determine when to begin harvest for winter (Slotte, 2000). (I am trying that.) Now our greater irregularities in weather include toxic pollutants in air and precipitation, which challenge soil life upon which trees depend, and directly interfere with tree metabolic processes (Mickler, Birdsey and Hom, 2000). The spring snow melt is an especially toxic event, at my farm; snow clears toxins from the air, then collects. When it melts, there is too much pollution at once. I notice dead zones in the garden, if I do not re-innoculate with live compost. Also we have lost one half the topsoil to erosion worldwide since 1950 (Pershouse, 2018), partly related to abandoning our role in cycling tree matter to our livestock and soil. So tree health and nutritional quality must be assessed tree by tree in deciding harvest times. We must notice tree clues, practice tasting, and offer samples to our animals.

Goats' fresh fodder refusals sometimes become acceptable dried fodder for them in winter, especially when plenty of grass hay is also offered. This winter they love dried red maple that they barely touched when freshly cut in late summer. Some leaves refused in summer, such as red oak and yellow birch in this summer of drought, continue to be refused in winter. Leaves high in antifeedant chemicals are likely to become more digestible when ensiled or cooked. Historically, leaf silage (leaves fermented anaerobically, by packing tightly in a pile, or sealing

in plastic or in containers) was even made using fallen leaves in autumn; such feed was traditional for cows and hogs (Maschatchek, 2002). My hogs and goats, plus cattle and sheep at 5 other farms responded positively to most leaves ensiled for our SARE FNE18-897 grant project. Austad, Braanaas and Haltvik (2003) ensiled shredded leafy twigs in barrels for sheep, with positive response. Michael Walder, Mahna Farms, Ontario, Canada, wants financial help obtaining a pelletizer, to experiment with heat and pressure to break down antifeedant tree chemicals in shredded leaf and twig fodder for Boer cross meat goats (Walder, 2017).

My goats prefer cuttings from a pollard over those from a standard tree; this difference is magnified in a dry year, as pollarded trees show resilience to drought. Pollarding should also increase soil resilience to water-logging, due to increase in root turn-over (Niinemets and Valladares, 2006; Austad and Losvik, 1998).

My goats especially value cuttings from a tree fed by a live pile of organic matter, or from a tree on very healthy soil; we notice those trees holding green leaves for a week longer into fall than other trees of the same species. Feeding the soil community improves health and carbon sequestration in the tree and the soil (Fox and Mickler, 1996; Pershouse, 2018). We can widen our harvest windows and raise quantity and quality of leaves by cycling ramial wood refuse, biochar, and leafy manure to soil microbes under the trees.

Gut microbes in deer are known to shift by season to match deer diets (Ullrey et al., 1964). My goats seem to require more of a stomach microbe shift for some leaves than others. One spring they took nibbles each time we went by a lusciously felled white birch; then on the third visit they ate the whole tree. We must give animals time, before recording a refusal. When offering a new fodder in an enclosure, it is safest health-wise to also offer familiar choices so they are not forced to binge.

Minerals in soil and plant species distributions are site specific. Animals will choose an array of foliage to best meet their individual dietary needs from that site. Also animals vary in their needs. My bucks have always eaten more beech and hazel in fall than my milking does. East Freisian-cross dairy sheep 4 miles from my farm refuse white cedar (Littlefield, 2017), though my goats and hogs, and sheep at a third farm devour cedar. Paul Hand's donkeys in England refuse apple leaves and bark (Hand, 2017), a favorite of almost every plant eating animal. Yet many animals agree: domestic rabbits at my farm stopped eating beech the same day as my goats, and in Sweden beech is similarly a spring fodder for sheep (Slotte, 2017).

In summary, a diary of dated livestock choices is a helpful site- and herd-specific guide to seasonal nutritional windows for tree species, yet with changing conditions, one should always offer samples to animals (or taste) before cutting a lot. Livestock can consume a broader species range and higher quantity of tree matter when of varied species or balanced with grass or grass hay; ensiling or heating can alternatively solve antifeedant issues, which increase from tree stress. Well-fed soil reduces such issues and broadens harvest windows (Fig.2&3).



(Fig.2) Browsing ash prunings in the front woods, 2014

Notes on feeding, carrying, and storing

The goats are very careful to avoid intestinal parasites by refusing fodder that has gotten dirty. So one must prop leaf sheaves, bundles, or individual branches on a brush pile, or hang bundles from a tree or pole tripod, or from a beam in a building, or strip smaller twigs with leaves into a finely meshed hay bag or wooden manger. A box, sled or bin works so long as one keeps it clean.

First the goats come along to where I cut, so they will carry some of the food in their bellies. In winter they can help pull the sled full of brush; I am re-building a baby stroller for them to use in summer. Michael Maschatchek (2002) shows a man using a wooden back pack frame first as a ladder, and then to carry a huge load of branches. For now, I don't mind some exercise of carrying a tied bundle on my head.

Håkan Slotte (2000) included pictures of many historic leaf sheaves packed tightly outdoors on storage racks, or in tall beautifully formed stacks. In 2016 we followed Håkan's directions for an outdoor rack (Fig.4), but this year we stacked outdoors under tarps. A barn hay loft is best. We put a tarp over, to protect from the sunlight.



(Fig.3) Quaking aspen, pruned late fall, 2016



(Fig.4) Red maple dried on an outdoor rack, with goats swarming, 2016

References

- Austad, I. & Losvik, M.H. (1998) 'Changes in species composition following field and tree layer restoration and management in a wooded hay meadow', in *Nordic Journal of Botany*, 18 ©, pp.641-662.
- Fox, S. and Mickler, R. A. (1996) Impact of Air Pollutants on southern Pine Forests. N.Y.,N.Y.: *Springer Science and Business Media* (Ecological studies 118).
- Harborne, J. B. (1991) 'The Chemical Basis of Plant Defense', in Robbins, C. T. and Palo, R. T. Plant Defenses Against Mammalian Herbivory. Boca Raton, FL: *CRC Press*, pp.45-59.
- Hand, P. (2017) Personal visit 1/30/17 -2/5/17. Bees and Trees, Lentwardine, UK.
- Kays, J. S., and Canham, C. D. (1991) 'Effects of Time and Frequency of Cutting on Hardwood Root Reserves and Sprout Growth', in *Forest Science*, 37 ②, pp.524-539.
- Littlefield, S. (2017) Verbal communication and observations in many visits. Y Knot Farm, Belmont, Me., US
- Mickler, R.A., Birdsey, R.A. and Hom, J. (eds.) (2000) Responses of Northern U.S. Forests to Environmental Change. N.Y., N.Y.: *Springer Science and Business Media* (Ecological Studies 139).
- Niinemets, U. and Valladares, F. (2006). 'Tolerance to shade, drought, and waterlogging of temperate northern hemisphere trees and shrubs'. *Ecological Monographs*, 76 ④, pp.521-547.
- Papanastasi, V.P., Yiakoulaki M.D., Decandia, M. and Dini-Papanastasi, O. (2008) 'Integrating woody species into livestock feeding in the Mediterranean areas of Europe', *Animal Feed Science and Technology*, 140 ①, pp.1-17.
- Ullrey, D.E., Youatt W. G., Johnson H.E., Ku P.K., and Fay L.D. (1964) 'Digestibility of Cedar and Aspen Browse for the White-Tailed Deer', *The Journal of Wildlife Management*, 28 ④, pp.791-797.
- Walder, M. (2017) Personal email communication 12/5/17. Mahna Farm, Ontario, Canada.