



# Willow silage

## what works and what doesn't

Sarah Depauw<sup>1</sup>, Annick Boeykens<sup>2</sup>, Jannes Van Houcke<sup>2</sup>

<sup>1</sup>Odisee University College, Agro- and Biotechnology, Sint-Niklaas, Belgium;  
<sup>2</sup>Odisee University College, Chemistry, Gent, Belgium

Contact sarah.depauw@odisee.be

Wintertime is a major challenge in European zoos housing browsers. At that time, the supply of fresh browse is scarce and the use of alternatives such as dried, ensiled or frozen browse is not widespread. The production of browse silage is fairly cheap and easy. However, besides the time consumption issue, zoos indicate their lack of confidence in this technique; partly due to the variation of protocols used among zoos. This study compared therefore existing ensiling protocols for willow silage and also evaluated lucerne as a plausible additive to optimize fermentation processes. Additionally, willow was wrapped in bales to explore the possibility of commercialization of browse silage. In comparison with a control, being willow ensiled without additive, 3 types of additives were investigated: (1) molasses (4% DM) and a homofermentative silage inoculant ( $10^8$  CFU/kg fresh willow); (2) nitrogen (flushing drum with 2 bar, during 1,5 min) and (3) fresh lucerne at a rate of 40% lucerne-60% willow.



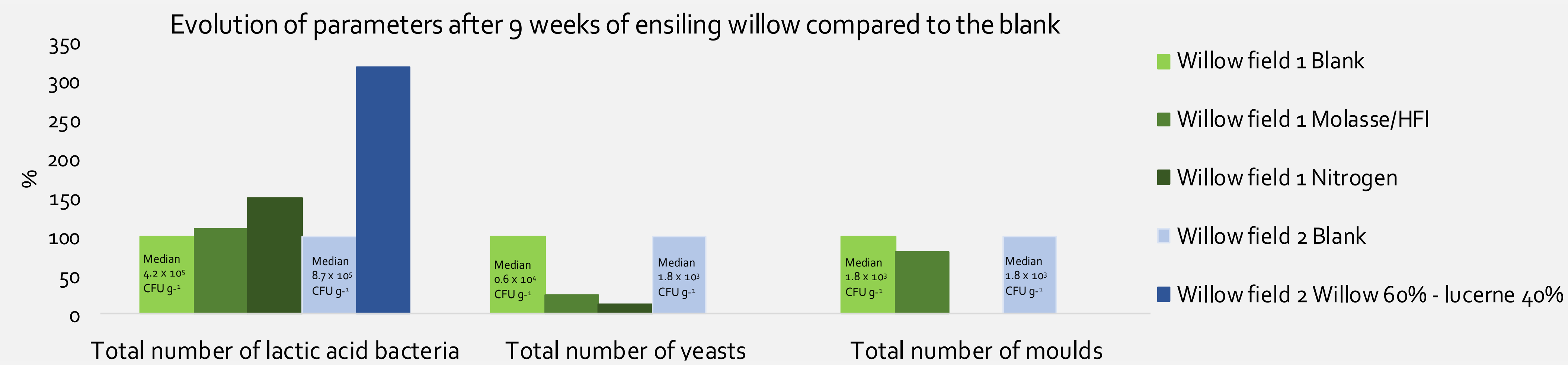
Two short rotation willow fields, intended for biomass, were used as willow source. In total, 2 tons of willow twigs (< 0.8 mm Ø, *S. burjatica* x *S. viminalis*) were manually harvested in the beginning of June 2018.



The willow was pressed into polyethylene drums (30L) with a self-developed automatic press machine (based on Lahance et al. 2012). Per additive, 3 drums were sampled at 9 weeks and 6 months of storage and compared with blank drums (no additives).



Willow was automatically pressed and wrapped in 300 kg bales by a local lucerne farmer. An extra layer of plastic was used to avoid piercing.



When using drums, zoos regularly detect fungal growth at the top layer of ensiled browse. This was also seen in this study, except when 40% lucerne was added.



				% on DM basis				
				pH	Dry matter %	Crude protein	Crude fat	Crude fibre
Field 1	Willow fresh		5,9	40,4	11,3	2,2	33,0	6,2
	Willow silage after 9 weeks	Blank	5,6	34,1	10,6	1,9	40,0	5,7
		+ Molasses/HFI	5,7	34,1	9,8	2,3	40,1	6,3
		+ Nitrogen	5,7	35,4	9,6	2,1	33,6	5,4
Field 2	Willow fresh		5,9	29,4	14,2	2,2	34,9	6,6
	Lucerne fresh		6,0	44,7	22,1	2,1	28,6	11,0
	Willow - Lucerne fresh 60-40%		6,0	35,5	17,4	2,2	32,4	8,4
	Willow silage after 9 weeks	Blank	5,5	28,2	16,0	1,8	36,2	6,3
		+ 40% Lucerne	5,0	35,2	16,5	1,9	35,7	8,2

- ⇒ The ensiling process did **not decrease** the **nutritive values** of the browse.
- ⇒ The pH of willow silage was comparable with previous findings in willow and apple silage. However, values are still relatively high since a pH of 4.2 is desirable. **Lucerne** was the only additive that resulted in a lower **pH** and markedly higher growth of lactic acid bacteria than the blank, which indicates better fermentation.
- ⇒ All additives decreased the growth of **yeast and mould**, but **lucerne** was the only additive that reduced the growth of mould and yeast to zero. All silages were however free of mycotoxines.
- ⇒ Poorly fermented silage can allow the growth of pathogenic microorganisms, such as **Listeria monocytogenes**. In many silage fermentations, the lactic acid levels are too low to drop the pH to 4.2, allowing *Listeria* and other organisms to proliferate. Since published data on *Listeria* in browse silage are lacking, we run a selective and specific test for *Listeria monocytogenes* and found in one blank barrel (field 1) a positive result.
- ⇒ The wrapping of willow in bales was successful and samples are currently under analyses. The use of short rotation willow fields for **commercialisation of willow bales** is not ideal since the narrow willow plantation does not allow automatically cutting of the willow shoots. Agroforestry practices such as alley cropping, in which food is cultivated between rows of trees, might be a better option to explore commercialisation of browse silage.