

Reduced climate change impact of milk achieved with introduction of **faba bean and clover grass** in dairy cows' diet

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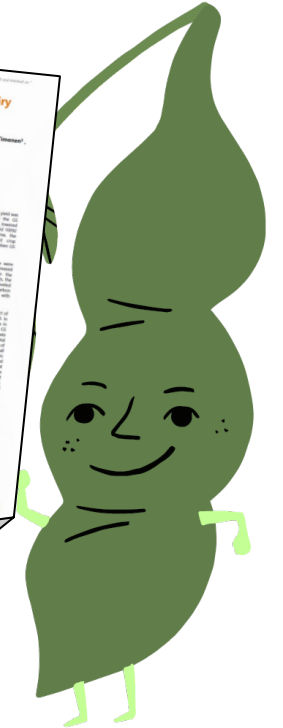
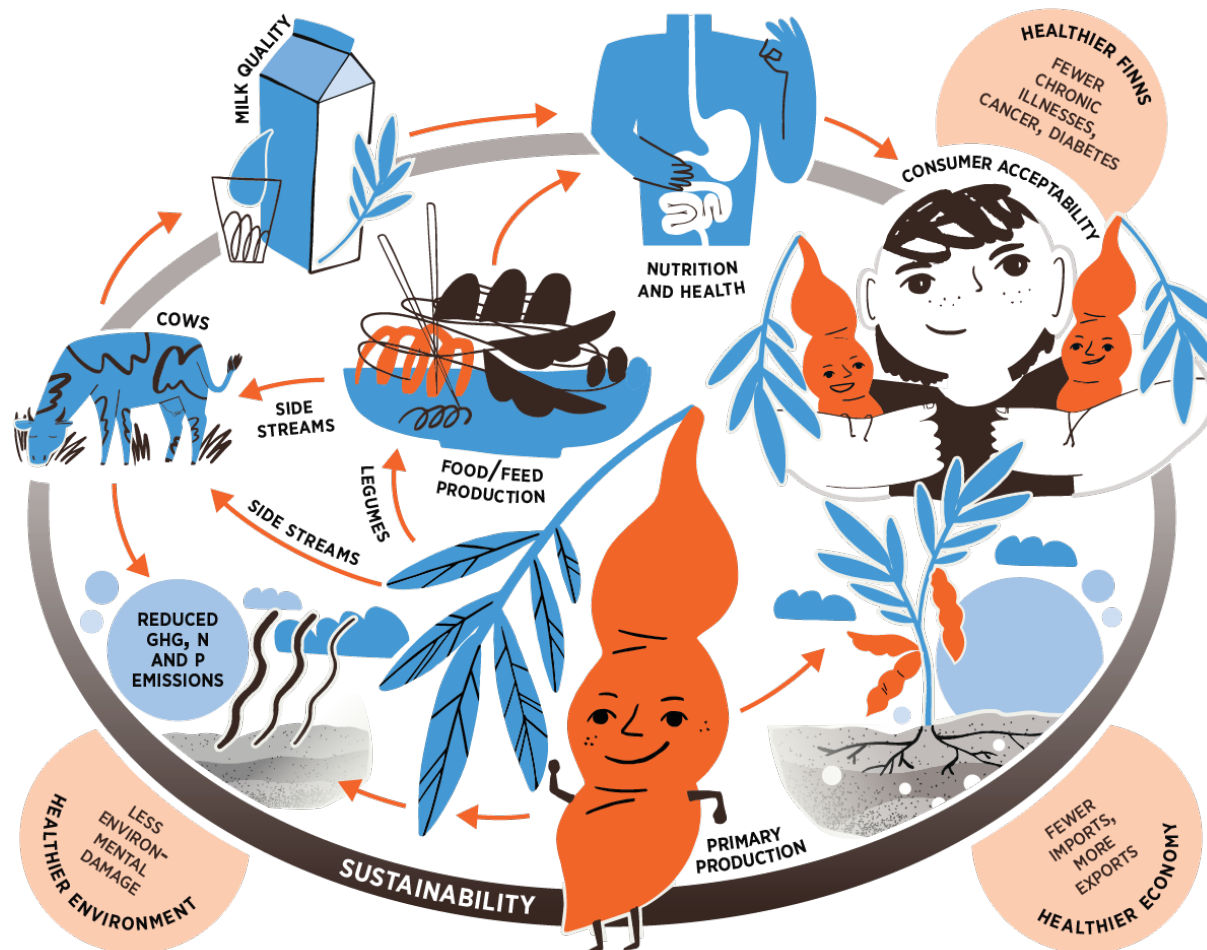
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Introduction – Leg4Life project

*“By **increasing the use of domestic legumes** a societal change is achieved **towards healthier and climate neutral food system**”*



Assessment of production scenarios of dairy - with and without legumes

Impact of 8 different diet scenarios for lactating cows, including 2 levels of concentrates, with and without legumes, to carbon footprint of milk

- Life Cycle Assessment model, based on Hietala et al. 2021
- Following ISO 14044 and IPCC methods in assessment of climate change impact
- System boundary from cradle to farm gate
- Functional unit 1 kg FPCM (fat and protein corrected milk)
- Biophysical allocation to meat and milk (IDF method)
- Results also 'per one dairy cow', for its lifetime



Assessment of production scenarios of dairy - with and without legumes

Life cycle assessment model includes all relevant processes from dairy system within boundaries:

- Input production (energy, fertilisers)
- Transportations
- Feed crop cultivation
- Animal processes (enteric fermentation, manure management),
- Energy use in housing and field work

Input variables:

- According to each scenario: Diet composition of lactating cows, feed crop cultivation and milk yields
- Diet composition during dry period, for heifers and calves were set constant
- Nr of calvings, slaughter age and slaughter weights were assumed constant
- Slurry system was assumed for all
 - N excretion according to N balance ($N \text{ feed} - N \text{ retention} = N \text{ Excretion}$)



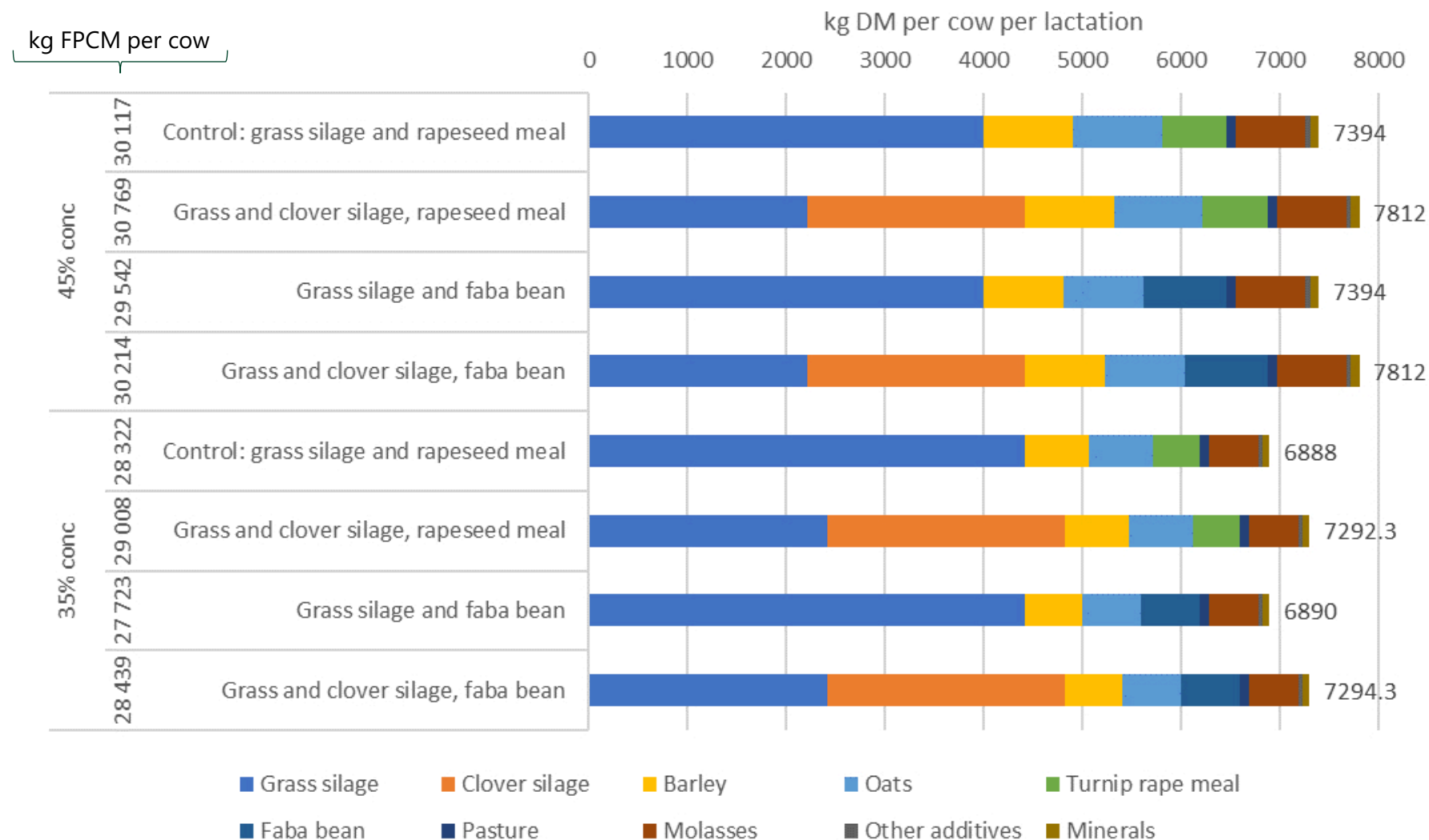
Feed crop production – with and without legumes as pre-crops

- **pre-crop effects of faba bean** were investigated regarding N inputs and yields
- Crop production characteristics based on Finnish parcel registry data (2015-2021), including:
 - Barley n=10610, oat n=6056, **Pre-crops: annual legume, n=692**
 - Inputs to crop production (manure, fertilizer, seeds)
 - Crop yields and management practises (ploughing, crop protection, etc.)
- Pre-crop effect was taken into account in feed crop LCA with reduced N input and increased yield:
 - **Barley: N input – 0.77 kg/ha, crop yield + 190 kg/ha**
 - **Oat: N input – 6.4 kg/ha, crop yield + 378 kg/ha**

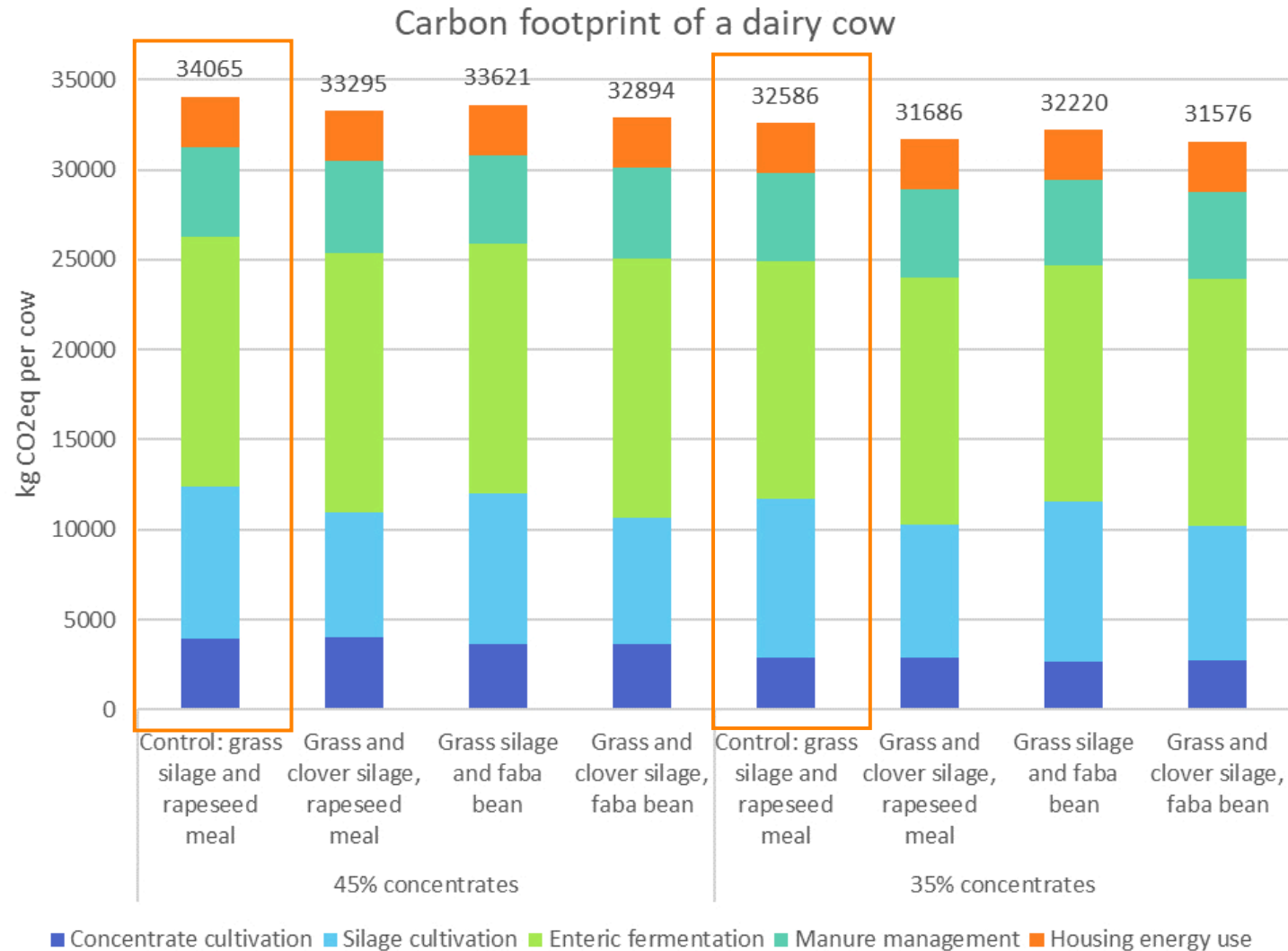
Modelled crop sequences with legumes:



Feed intake, per dairy cow, 8 scenarios

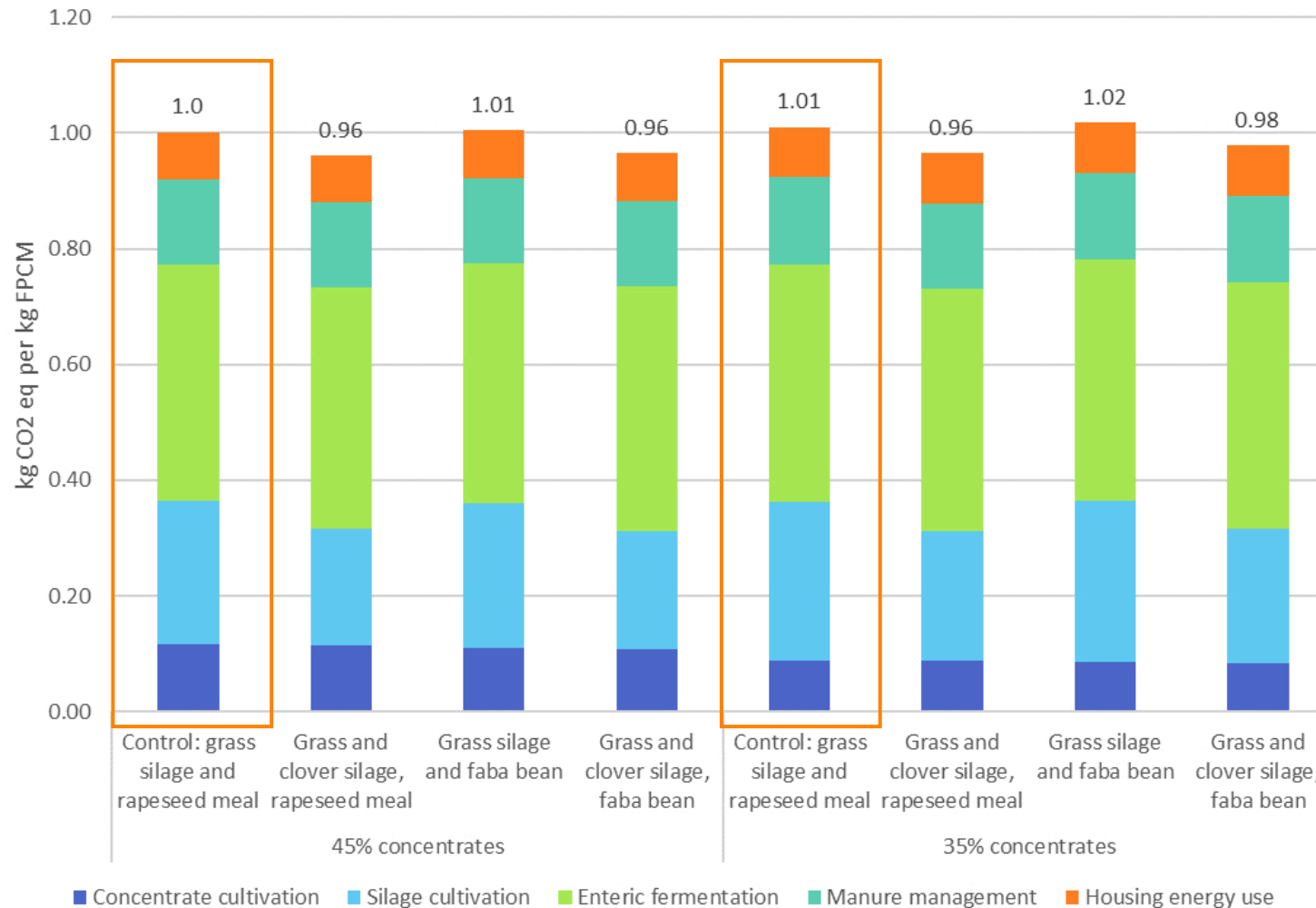


Results – Climate change impact per cow in total

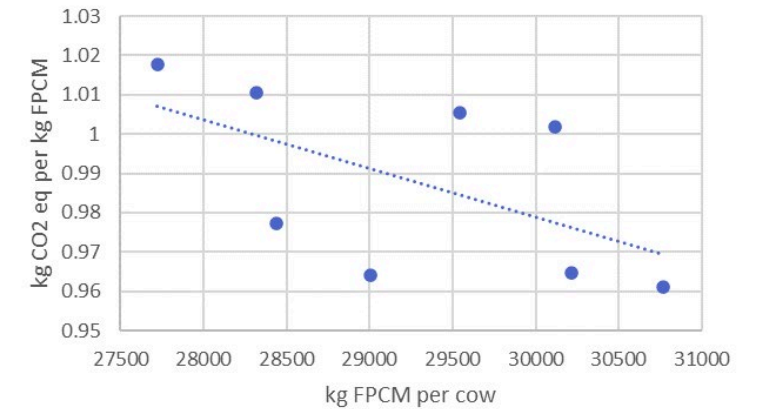


Results – per kg FPCM

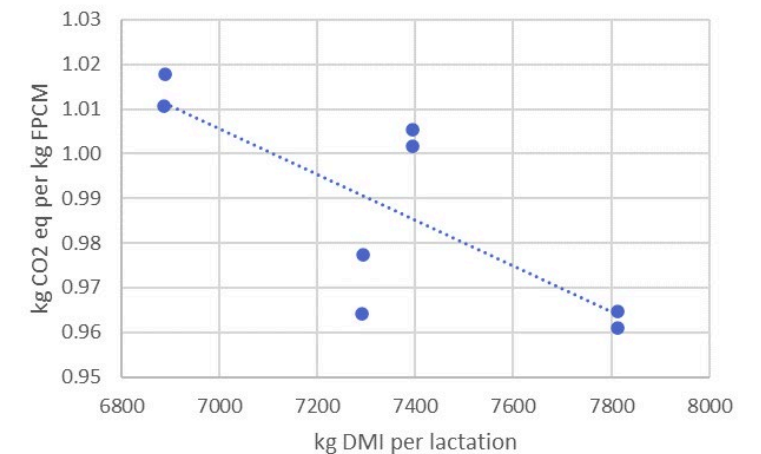
Carbon footprint of milk (1 kg FPCM)



Carbon footprint of 1 kg FPCM vs total milk yield



Carbon footprint of 1 kg FPCM vs kg DMI



Conclusions

- Both clover grass and faba bean had mitigating impacts to feed crop cultivation impacts
- Dairy cows total emissions were lower in all cases in comparison to controls
- Milk yield played major role: with highest FPCM yields the CF of milk was also lowest
- Clover grass and faba bean together lowered CF of milk by 3 - 4% in comparison to controls
- In further studies,
 - Inclusion of land use and eutrophication impacts to this assessment



Research group

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www.leg4life.fi



Thank you!