Optimized growth and preservation of energy crop

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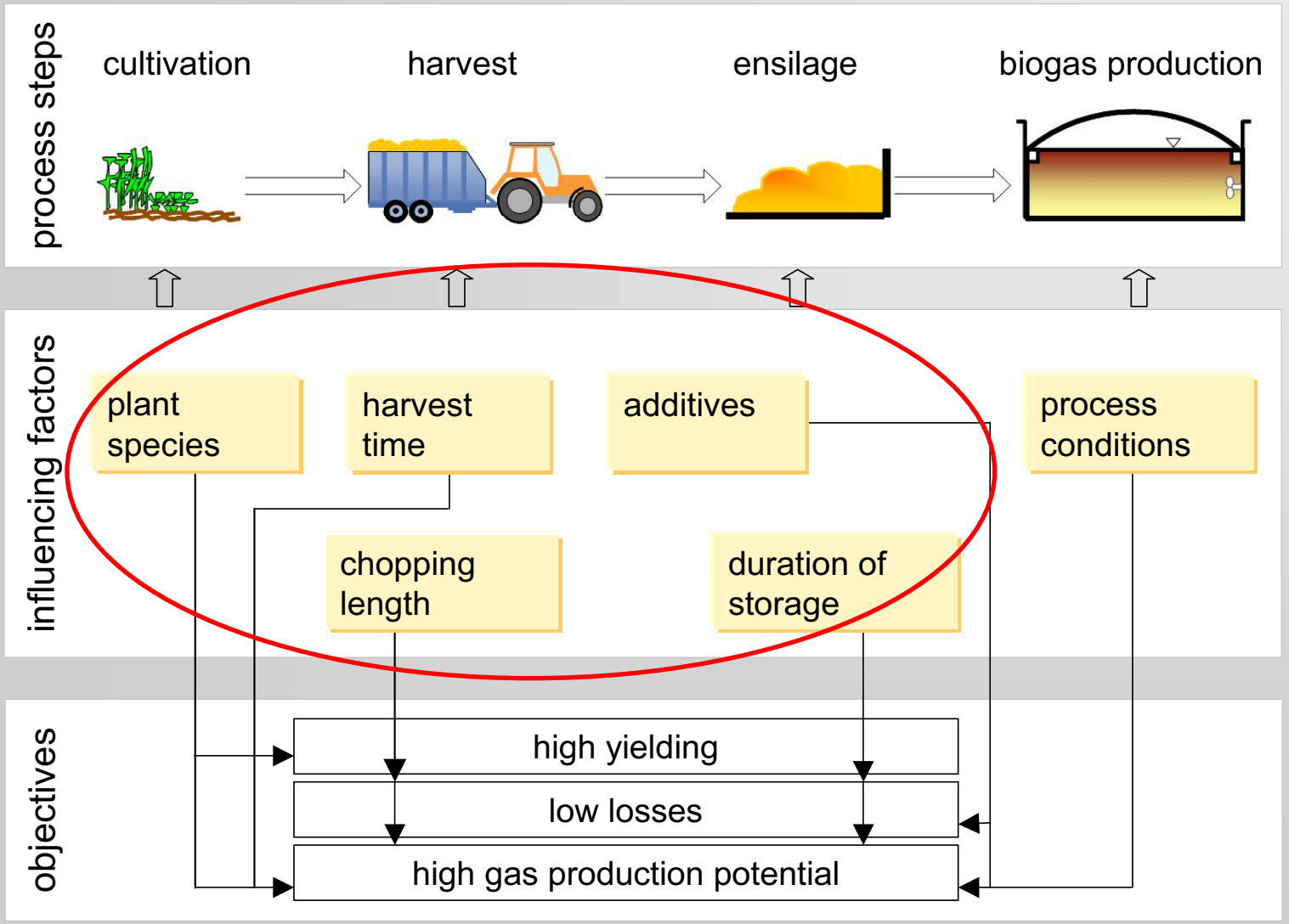
Preservation of energy crops

- Overview

- EVA-Subproject IV
- Methods
- Results
- Conclusion

EVA-Subproject IV: Ensiling/Biogas



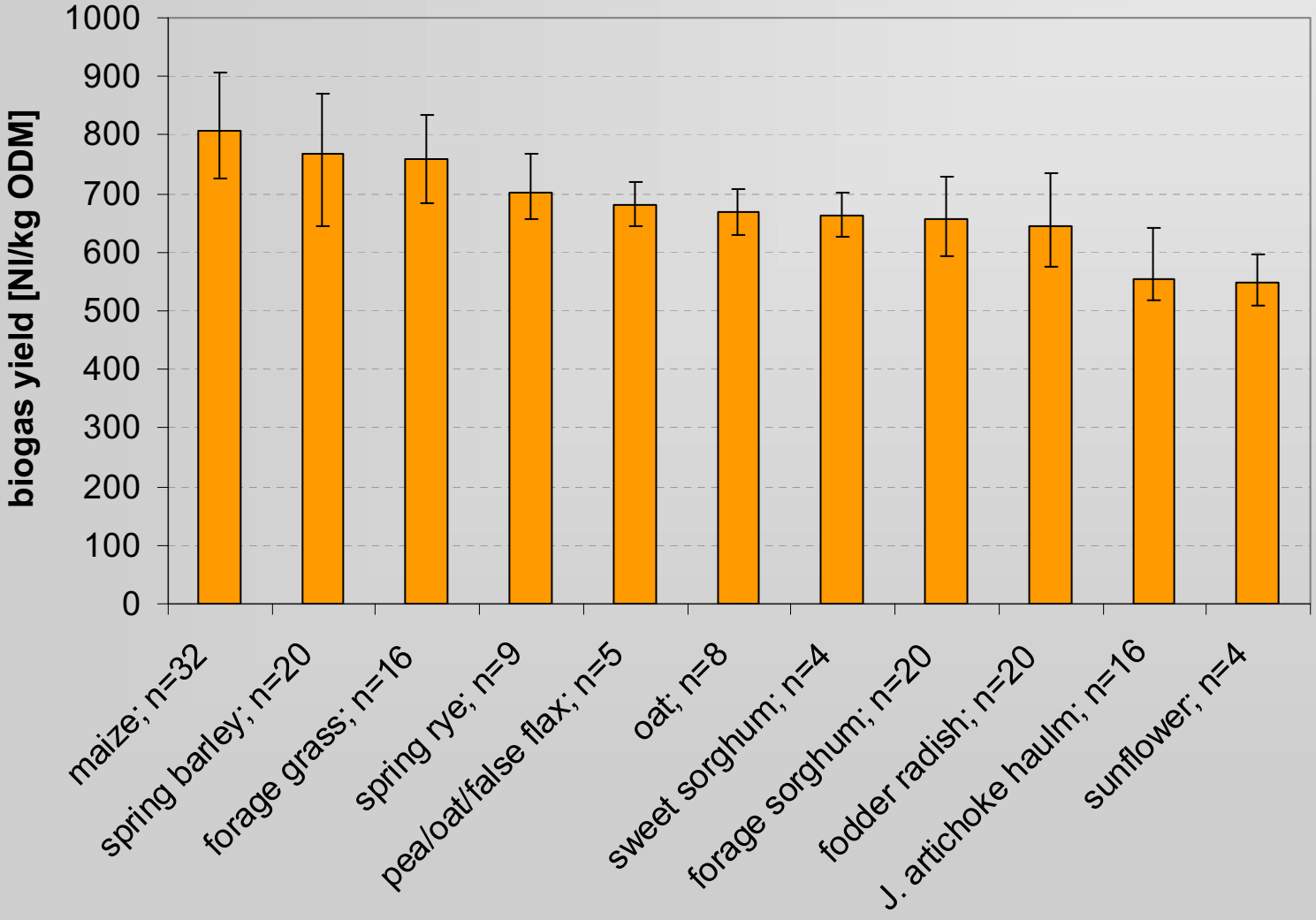
Methods

- Lab scale silos
  - 1.5-litre glass silos
  - Storage: 25°C, 90 days

- Anaerobic digestion
  - Batch test, 2.0-litre bottles
  - Conditions: 35°C, 30 days

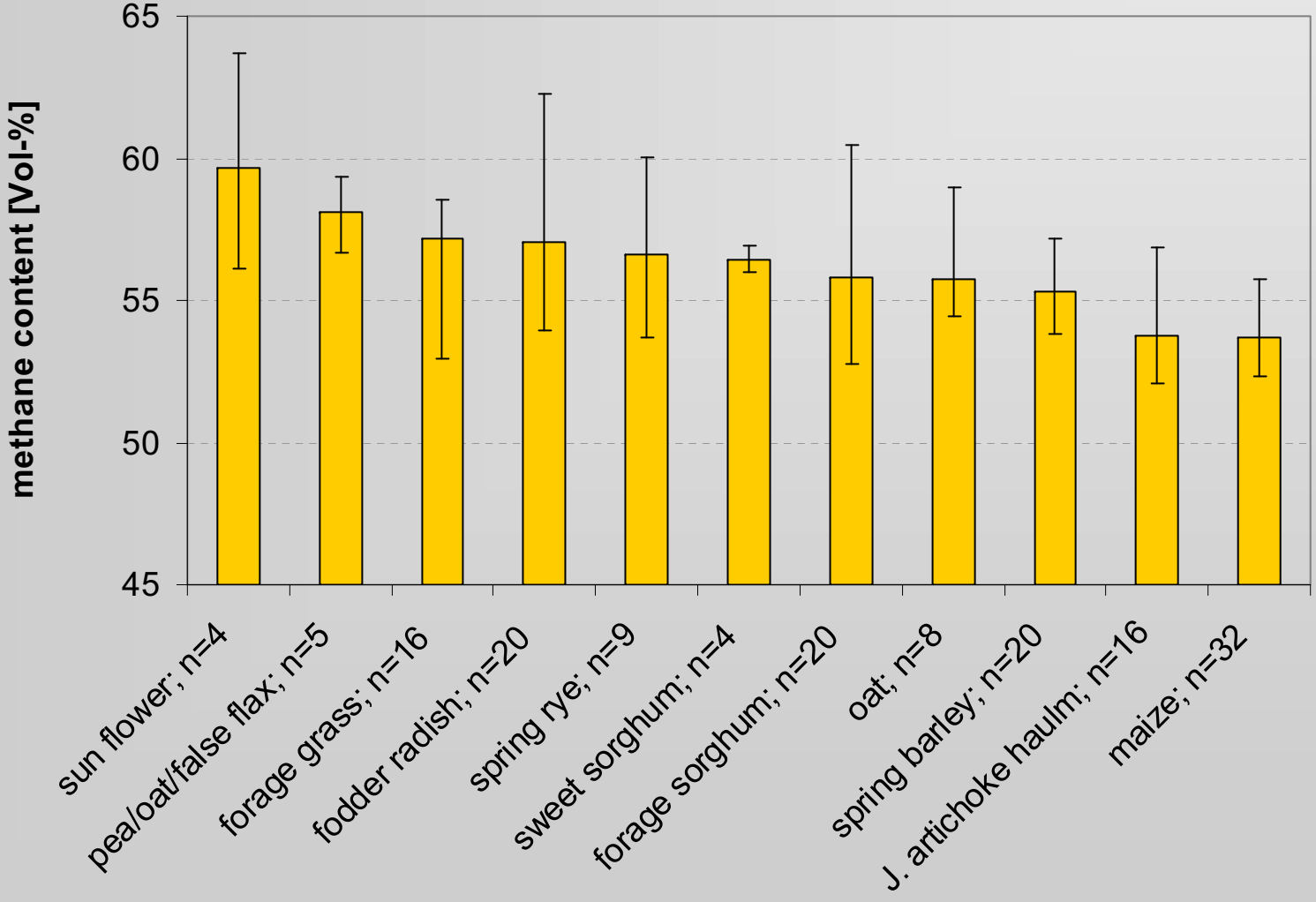
Plant species - Biogas

- Silages (n=162)



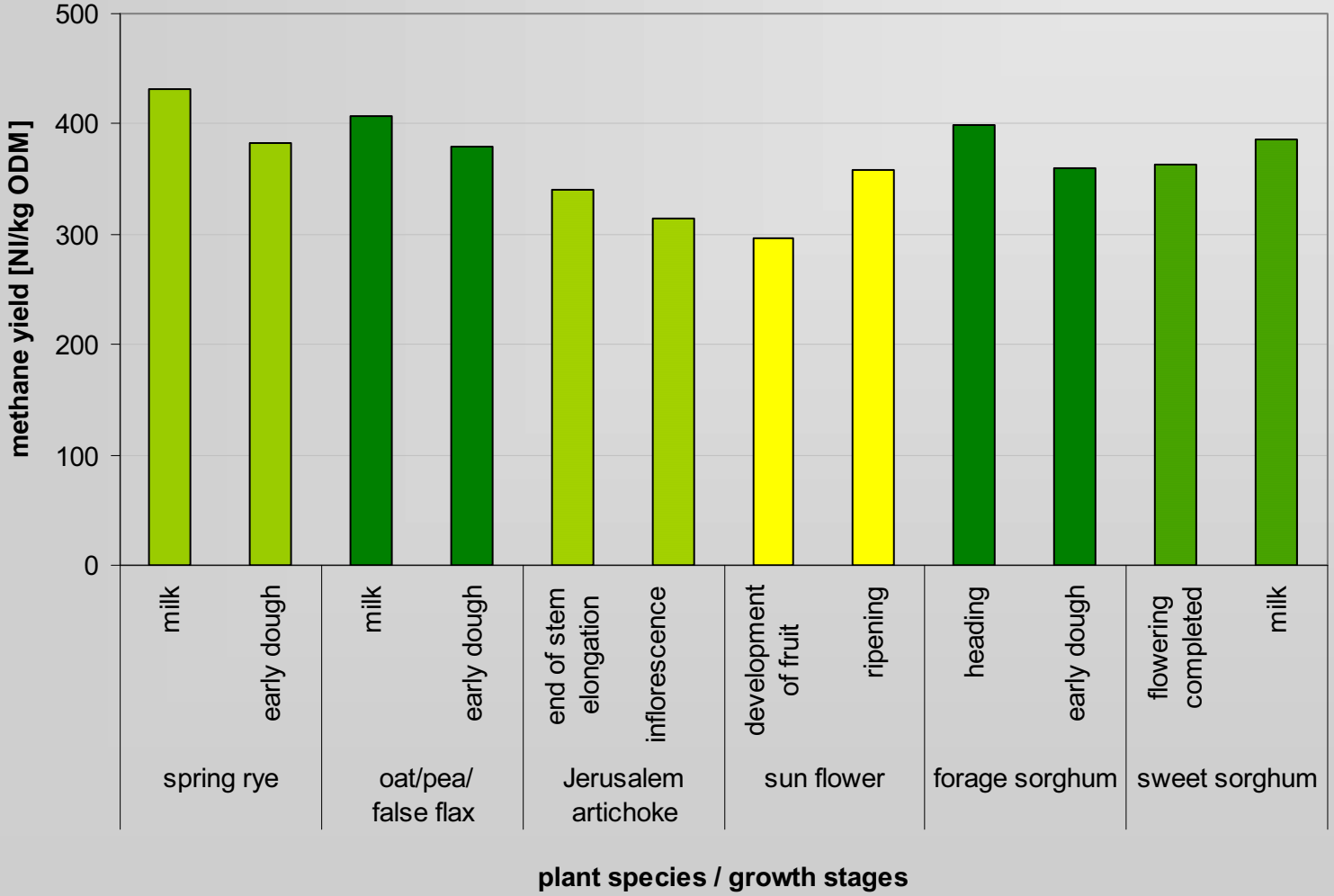
Plant species - Methane

- Silages (n=162)



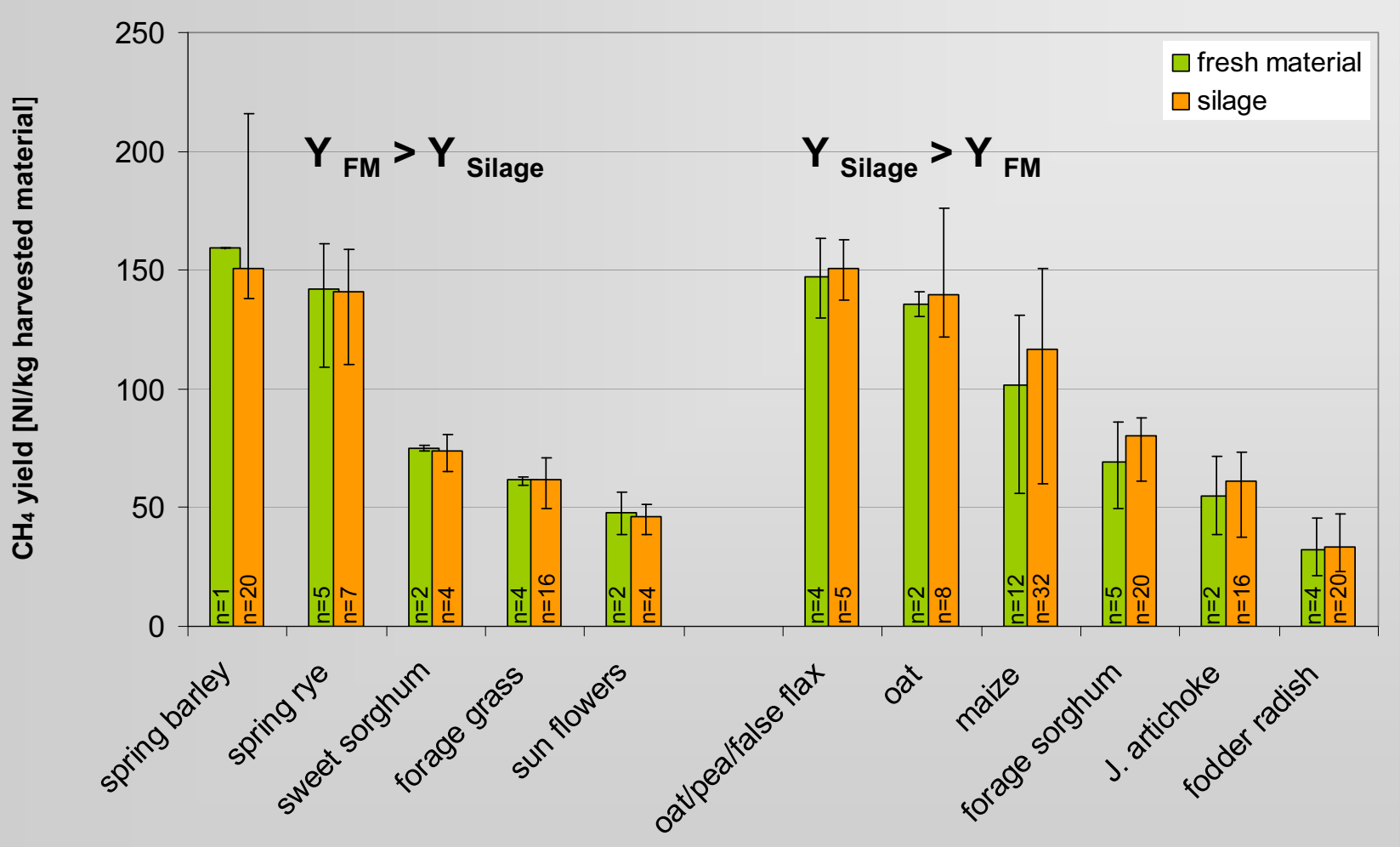
Plant species – Harvest time

- Silages



Impact of ensiling process

- Methane yield



Ensiling process: Fermentation quality

Plant species	Very good [%]	Good [%]	Mean [%]	Poor [%]	Very poor [%]
Maize	98				
Forage grass	92	8			
Alfalfa/grass	100				
Spring rye	50		8	34	8
Spring barley	79	17	4		
Oat	60	33	7		
Triticale	67	33			
Forage sorghum	100				
Sweet sorghum	100				
Sun flowers	75	12.5			12.5
J. artichoke	100				
Fodder radish	21	12.5	54		12.5

Classsification according to DLG-code

Ensiling process: Additives

Additives	Active substance	Effect
MAIS KOFASIL LIQUID	Chemical additive	aerobic stability
BIOSIL	Bacterial culture homofermentative strains *Lactobacillus plantarum*	fermentation
BONSILAGE PLUS	Homofermentative and heterofermentative lactic acid bacteria	aerobic stability + fermentation
SILASIL ENERGY	Selected homofermentative and heterofermentative lactic acid bacteria strains	enhanced acetic acid production

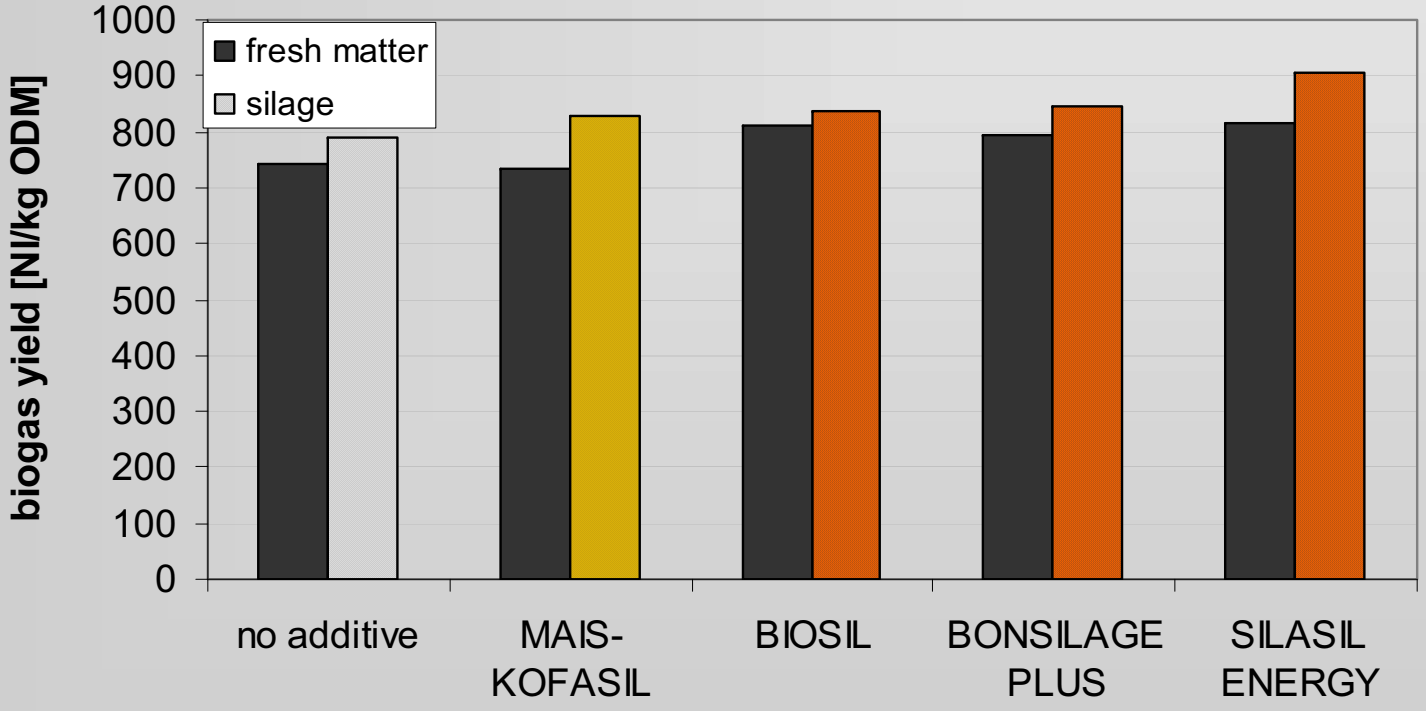
Ensiling process: Silage quality

Additve	DM-content [%FM]	DM-loss [%]	pH	LA [%DM]	AA* [%DM]	BA** [%DM]	Alcohol [%DM]
None	35.0	7.8	3.6	2.7	1.1	1.1	1.3
MAIS KOFASIL	34.2	6.3	3.5	2.8	3.3	0.0	1.3
BIOSIL	36.4	2.8	3.3	4.8	0.5	0.0	1.1
BONSILAGE PLUS	34.9	3.8	3.6	2.8	0.3	0.1	0.1
SILASIL ENERGY	36.5	1.7	3.9	0.8	3.7	0.0	1.3

* acetic- und propionic acid
** isobytric-, butric-, isocaproic-, caproic-, isovaleric-, valeric acid

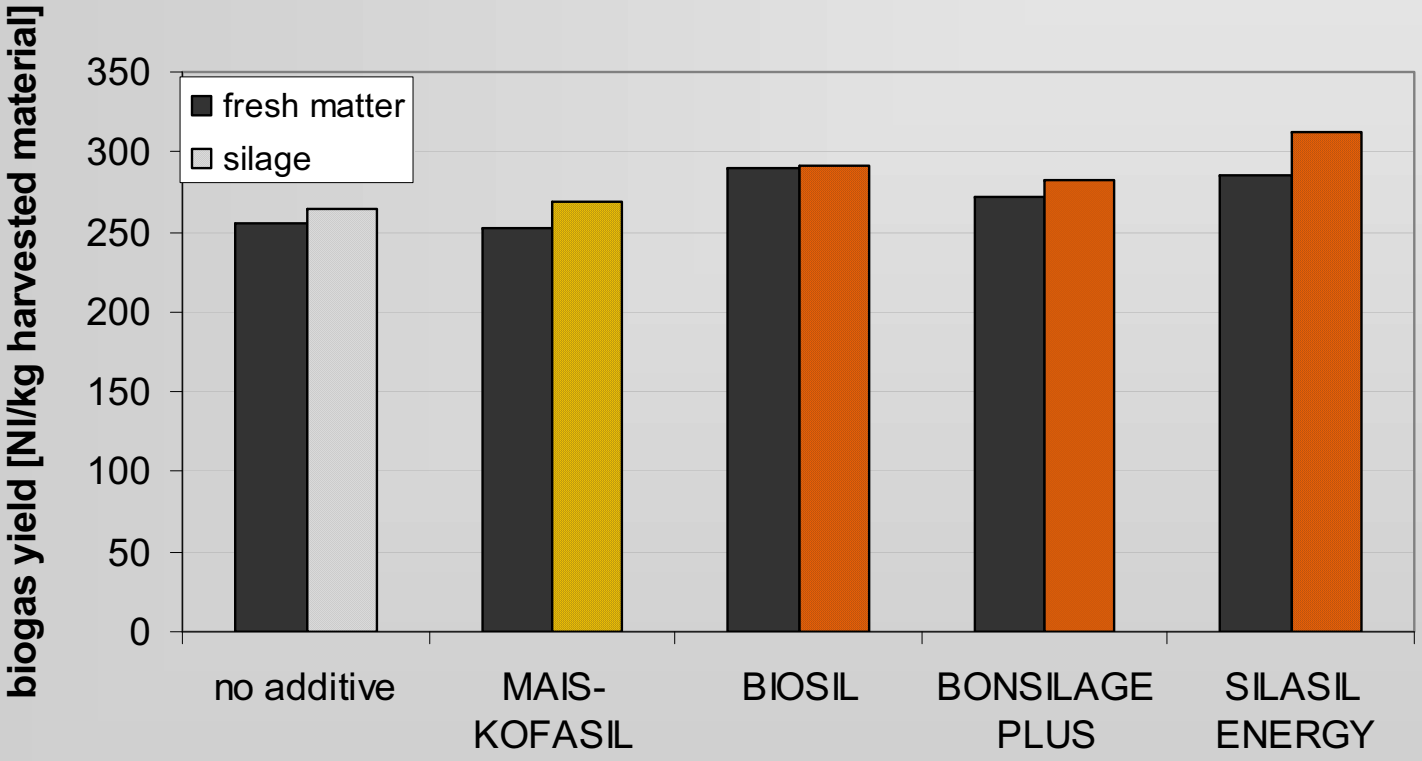
Ensiling process: Additives

- Maize



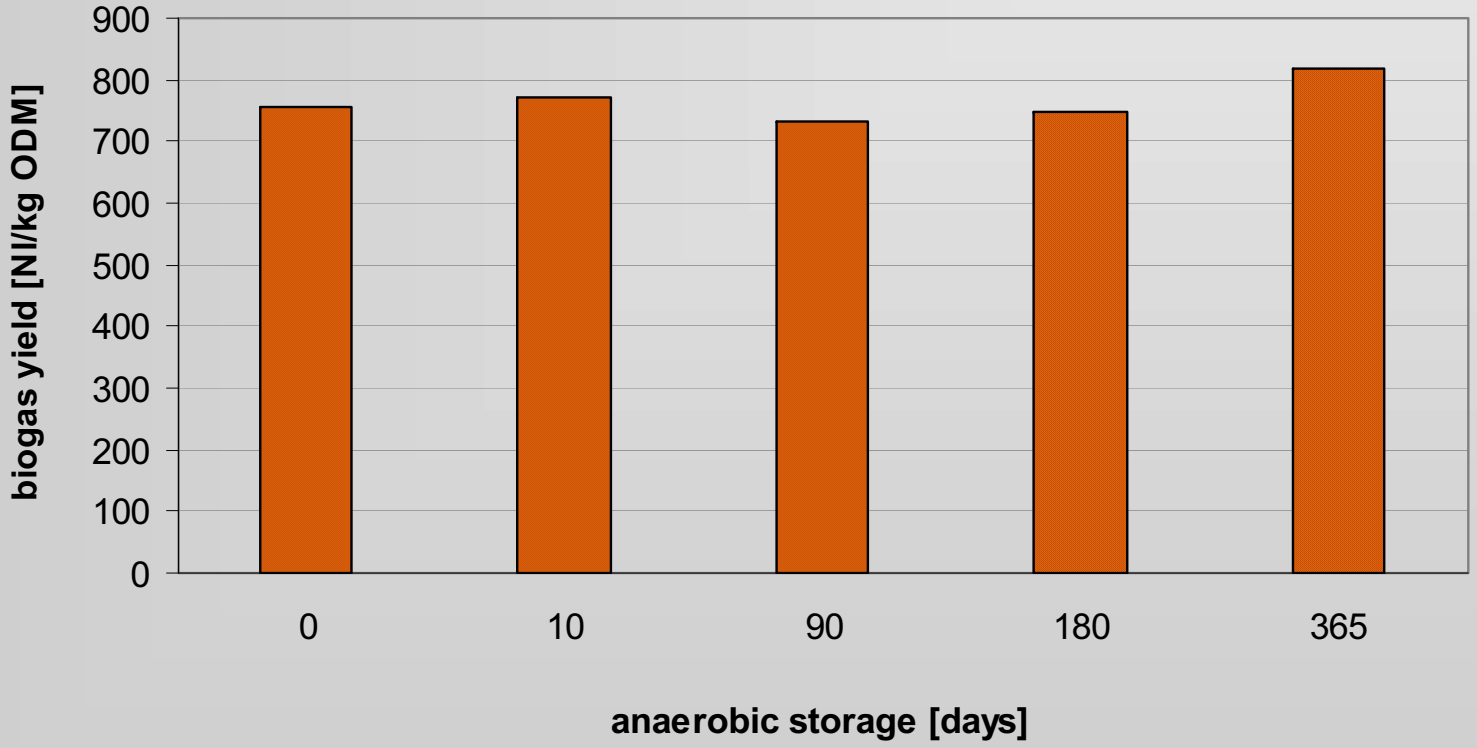
Ensiling process: Additives

- Maize



Ensiling: Duration of storage

- Maize + Additive



Conclusion

- Numerous plant species are suitable for anaerobic digestion achieving high gas yields
- Variations of biogas yield within crop species depend on site-specific conditions, variety, cultivation intensity
- Maize is the preferable plant species followed by forage sorghum, triticale and spring barley
- Harvest time has an impact on methane formation process via chemical composition of plant material
- Maturity stage at harvest also affects biomass yield and ensiling process (fermentation quality)
- Additives investigated have a positive effect on silage quality and minimised DM-losses
- Investigated storage periods (up to 365 days) for whole crop silages show no negative effect on biogas yield

Thank you!

- **Proceedings** "Parameters Influencing Substrate Quality and Biogas Yield"

- **Poster**
  Group IV: Visual Presentation VP T1.3
  Wednesday, 9 May 16:45 - 18:10

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