Mære landbruksskole, plastic wrapping vs concrete silos, GHG analysis

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Background

- This presentation shows the result the difference of GHG emissions between the use of plastic foil wrapping and concrete silos for grazing in Mære Landbrukskole

Method

- A lifecycle assessment of the use of concrete and plastic foils (for silos) and plastic wrapping and plastic net (for bales)
- Used stages: A1-A3 (material production), A4 (transportation to Mære), B4 (replacement)
- Time horizon: 50 years
- Calculations are based on the amount of grazing equivalent to 1500 bales

Method

Materials quantities for silos:

- 47.3 m3 of concrete for the silos construction
- 147 m3 of concrete for the silos platform
- 1152 m2 of plastic foil, 40 micron thickness for weather protection
- 1152 m2 of plastic foil, 115 micron thickness for weather protection
- Plastic foil is replaced every year

Method

Materials quantities for bale wrapping:

- 100 rolls of plastic foil, 25 micron thickenss, for a total of 123 750 m2
- 5 rolls of plastic net, for a total of 22 140 m2
- Plastic foil and net are replaced every year

Betong plansilo

Grunnflate 700 m^2
Volum 1600 m^3 (fyller ikke topp)
Betong 200 m^3 varighet 50 år
Dekkes med 1150 m^2 plast,
40 micron + ekstra lag 115 micron
(LDPE)

Rundballer

100 ruller plast 25 micron -123 750 m^2
5 ruller plast nett, 22 140 m^2
(LDPE)

Product	kgCO2eq/year
Referanse betong B30	1 457
Lavkarbon B B30	1 263
Lavkarbon A B30	1 146
Lavkarbon Plus B30	952
Rundballer plast+ nett	6 708
Rundballer ecoplast+ nett	5 560

Method

Assumptions for concrete CO2eq factor (A1-A3)

- To have a comparison of the GHG emissions impact given by different concrete types, the following standard values are used:
- Concrete type B30
- Carbon class: reference, Lavkarbon B, Lavkarbon A, Lavkarbon Pluss
- From Norsk Betongforening Publikasjon nr. 37

Fasthetsklasse [1] og lavkarbonklasse	B20	B25	B30	B35	B45	B55	B65
Maksimalt tillatt klimagassutslipp [kg CO_2-ekv. pr m^3 betong]							
Bransjereferanse	240	260	280	330	360	370	380
Lavkarbon B	190	210	230	280	290	300	310
Lavkarbon A	170	180	200	210	220	230	240
Lavkarbon Pluss [2]			150	160	170	180	190
Lavkarbon Ekstrem [2]			110	120	130	140	150

Method

Assumptions for plastic foil CO2eq factor (A1-A3)

- Plastic foil for both silos and bale wrapping is assumed to be Low Density Polyethilene (LDPE)
- Environmental Product Declarations of several LDPE foils are used to derive an average CO2eq factor for 1m2 of LDPE foil, with an average thickness of 181 micron.
- The CO2eq factor of the foils used in Mære is obtained by assuming the environmental impact of LDPE foil decreases proportionally to its thickness
- For silos: foil thickness of 40 and 115 micron
- For bales: foil thicknes of 25 micron
- Some producers market sustainable plastic wrapping (based on recycled plastic or bio-based plastic).
- It is assumed that 20% of CO2eq can be saved by using a sustainable plastic wrapping

Method

Assumptions for plastic net CO2eq factor (A1-A3)

- Plastic net is assumed to be High Density Polyethilene (HDPE)
- Environmental Product Declarations of HDPE foil is used to derive a CO2eq factor for 1m2 of HDPE foil with a density of 195 g/m2.
- The density of the plastic net is derived by a similar product from the same producer (10 g/m2)
- The CO2eq factor of the plastic net used in Mære is obtained by assuming the environmental impact of HDPE foil decreases proportionally to its density

Method

Assumptions for transport CO2eq factor (A4)

- EPDs are used to derive the value of CO2eq emissions for the transportation of concrete and plastic products
- The obtained value is given as CO2eq/km/unit of material (m3 for concrete, m2 for plastic foil)
- A distance of 50 km is used for calculating the transport for all the materials

Assumptions for replacement CO2eq factor (B4)

- all plastic products are assumed to be replaced every year, and not reused for other purposes on site

CO2eq values used in calculations

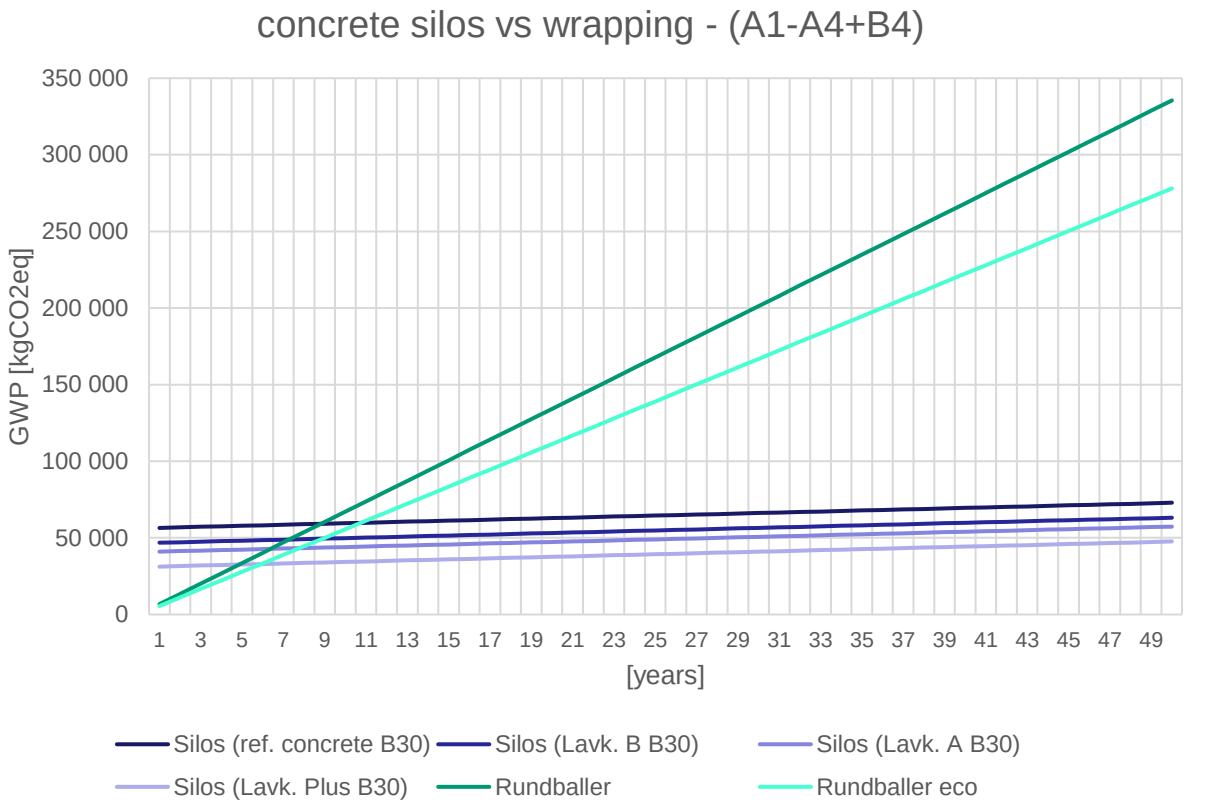
Concrete silos	A1-A3	A4	B4
Reference concrete B30	280 kgCO2eq/m2	0.39 kgCO2eq/m3 km	none
Lavkarbon B B30	230 kgCO2eq/m2	0.39 kgCO2eq/m3 km	none
Lavkarbon A B30	200 kgCO2eq/m2	0.39 kgCO2eq/m3 km	none
Lavkarbon Plus B30	150 kgCO2eq/m2	0.39 kgCO2eq/m3 km	none
Plastic foil 115 micron	0.21 kgCO2eq/m2	0.000018 kgCO2eq/m2 km	Every year for 50 years
Plastic foil 115 micron	0.21 kgCO2eq/m2	0.000018 kgCO2eq/m2 km	Every year for 50 years
Bale wrapping			
Plastic wrap 25 micron	0.05 kCO2eq/m2	0.000018 kgCO2eq/m2 km	Every year for 50 years
Plastic wrap eco 25 micron	0.04 kCO2eq/m2	0.000018 kgCO2eq/m2 km	Every year for 50 years
Plastic net	0.04 kCO2eq/m2	0.000018 kgCO2eq/m2 km	Every year for 50 years

Results

Cumulative KgCO2eq for 50 years

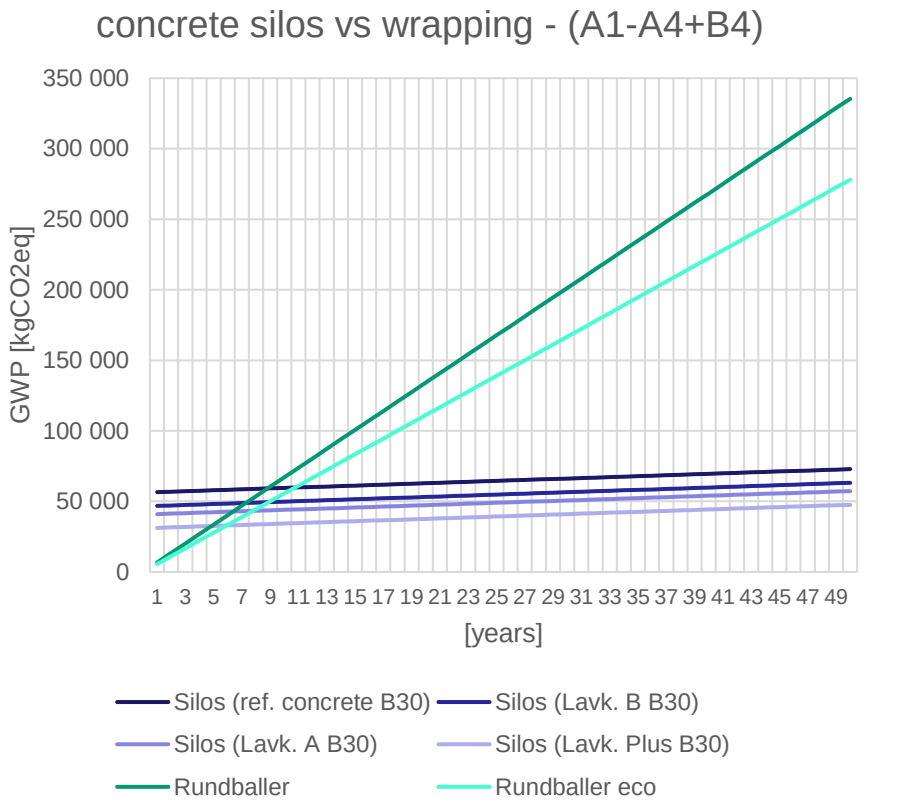
Concrete silos show less impact than bale wrapping after 5-11 years (depending on the concrete type)

After 50 years, the emissions of bale wrapping are 3.8 times and more than the emissions of concrete silos



Results

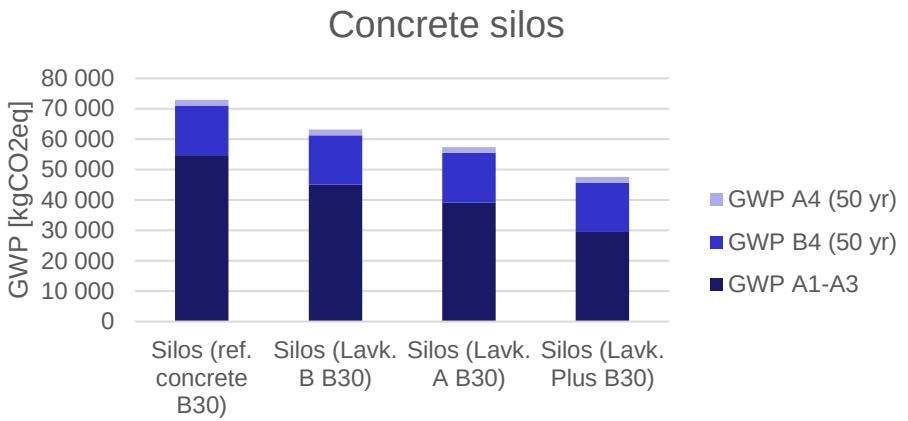
Product	kgCO2eq/year	Reduction from average bale wrapping
Reference concrete B30	1 457	76%
Lavkarbon B B30	1 263	79%
Lavkarbon A B30	1 146	81%
Lavkarbon Plus B30	952	84%
Plastic wrap + net	6 708	6134
Plastic wrap eco + net	5 560	

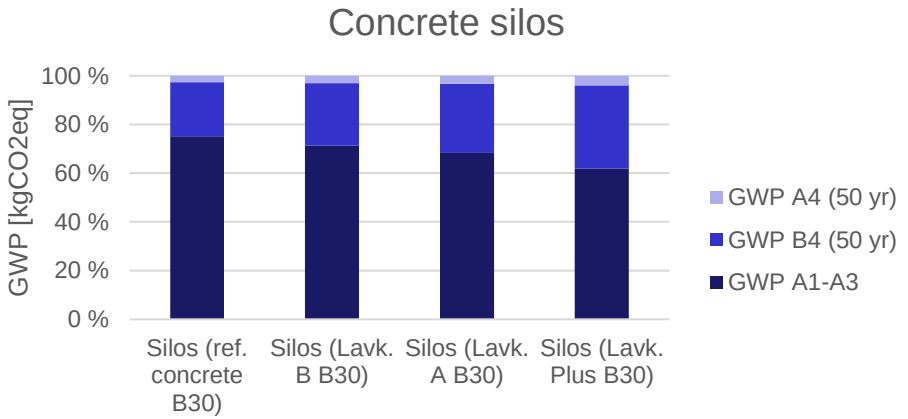


Results

GHG emissions of standard concrete can be up to 1.5 times of low carbon concrete (lavkarbon pluss type)

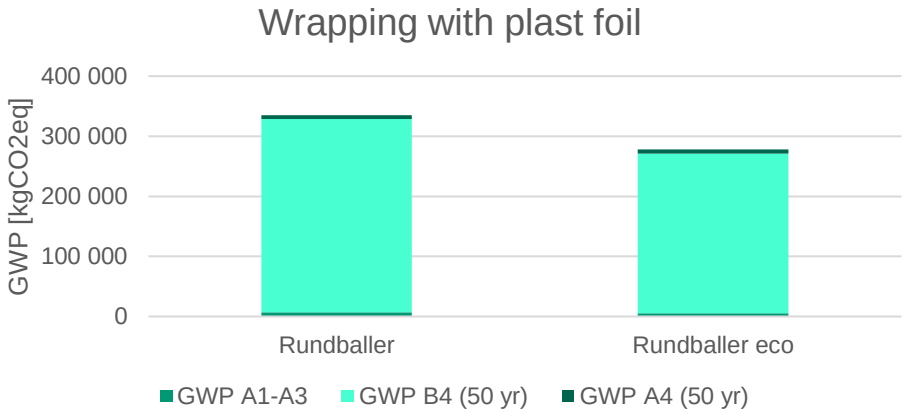
At least 60% of the total emissions are due to production (A1-A3) (lavkarbon pluss type)

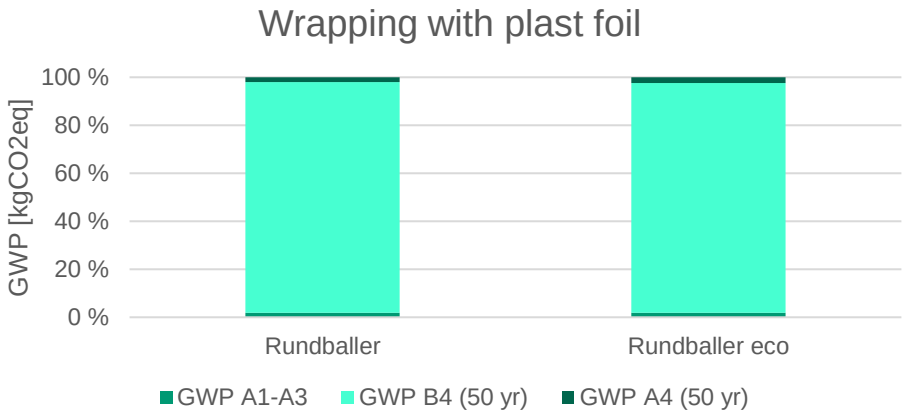




Results

More than 95% of the emissions are due to the production of new plastic foil for the replacement of the used one (B4)





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