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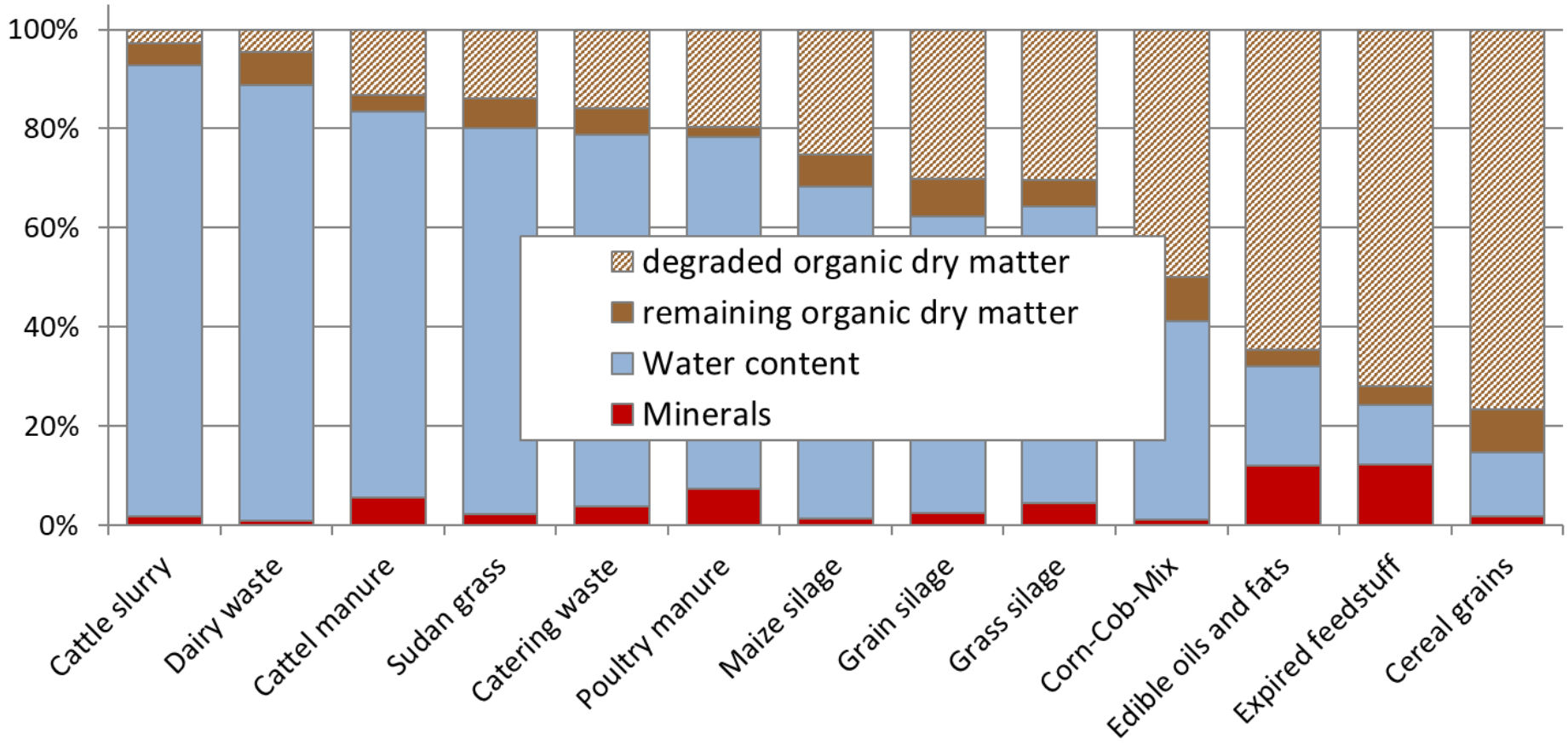
# Digestate Values and Application Technologies

DiBiCoo, 22nd April 2021

# Mass degradation
## of various types of feedstock




Stürmer et al., 2021

# Humus reproductive output

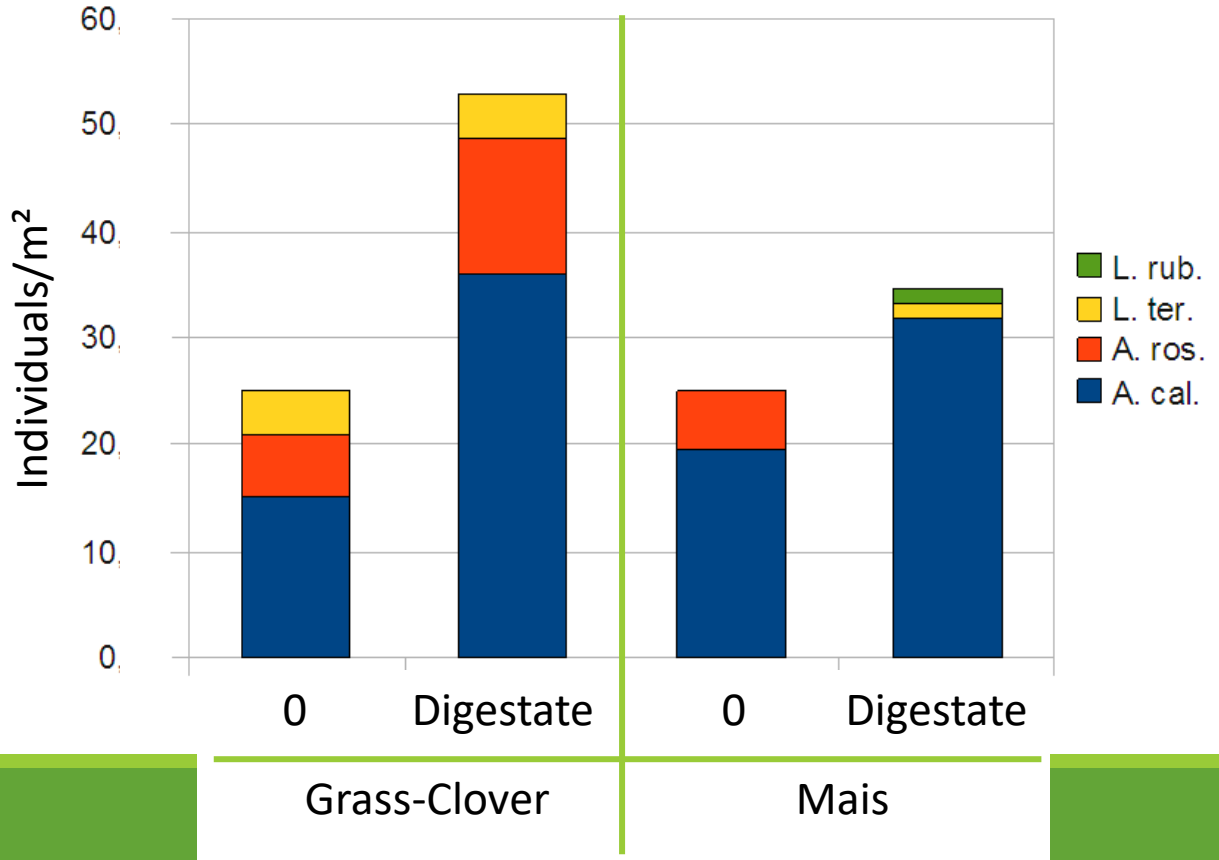
| Organic matter | DM % | Humus reproduction | |
|---|---|---|---|
| | | kg Humus-C $t^{-1}$ | Comparative to manure % |
| **Pflanzenmaterial** | | | |
| Straw | 86 | 80 bis 110 | 58 bis 80 |
| Catch crops | 10 | 8 | 50 |
| **Manure** | | | |
| fresh | 20 | 28 | 88 |
| rotten | 25 | 40 | 100 |
| **Slurry** | | | |
| Swine | 8 | 8 | 63 |
| Cattle | 10 | 12 | 75 |
| **Digestate** | | | |
| liquide | 10 | 12 | 75 |
| solid | 25 | 36 | 90 |

VDLUFA 2004; 2014

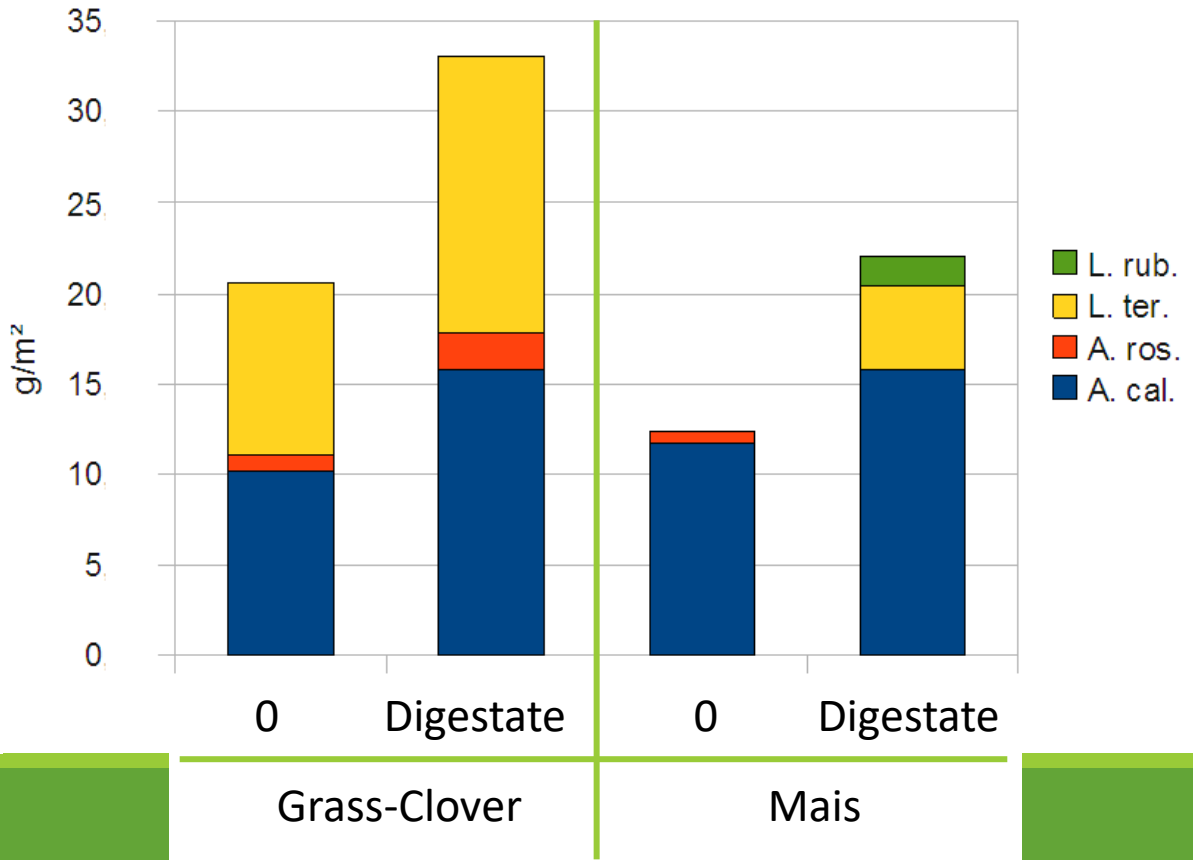
# Earthworm population

(Thoma-Rademacher, 2010)

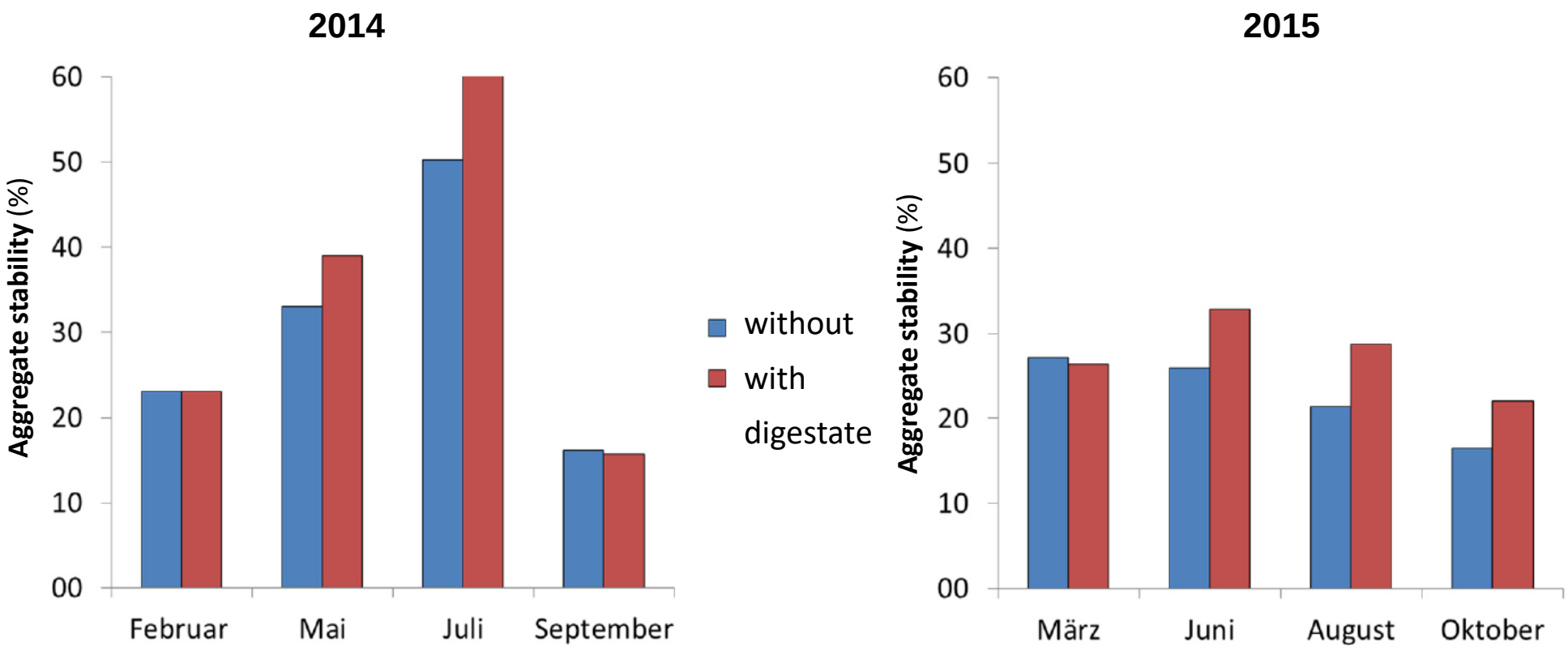
INDIVIDUALS




BIOMASS

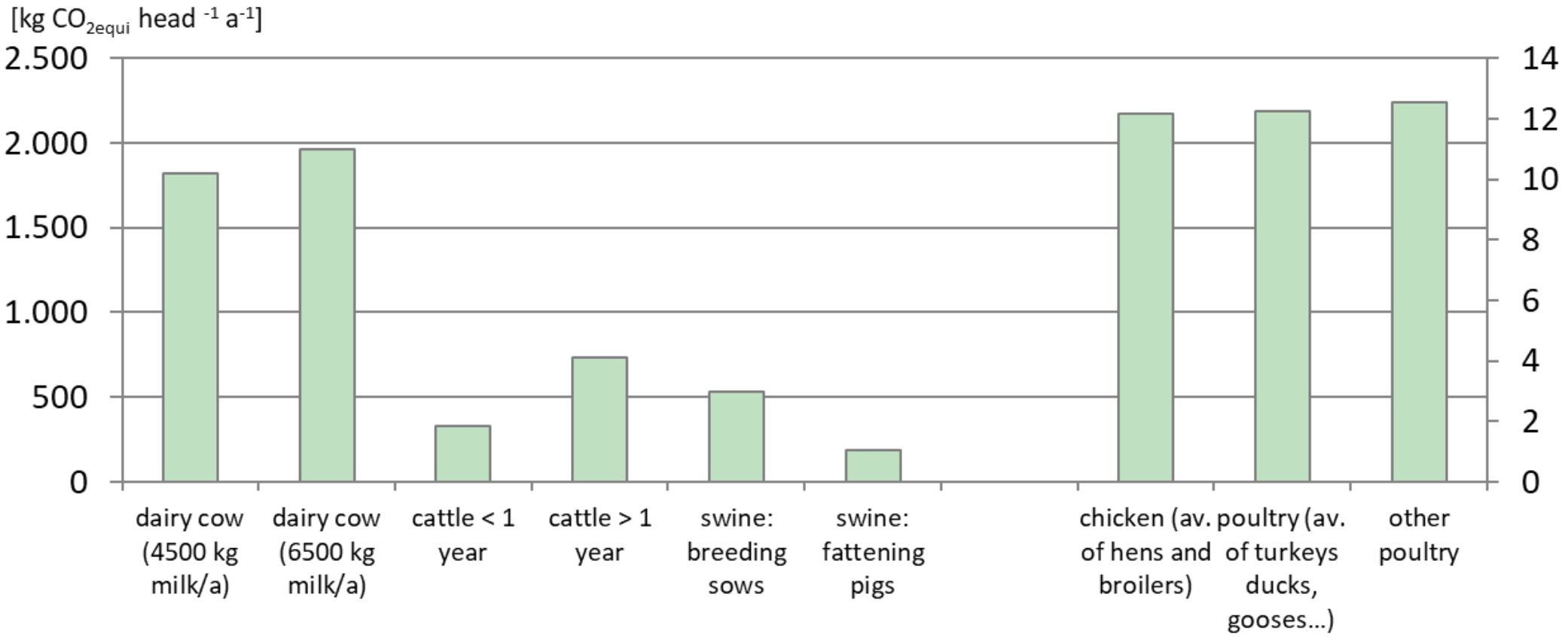


# Soil aggregate stability



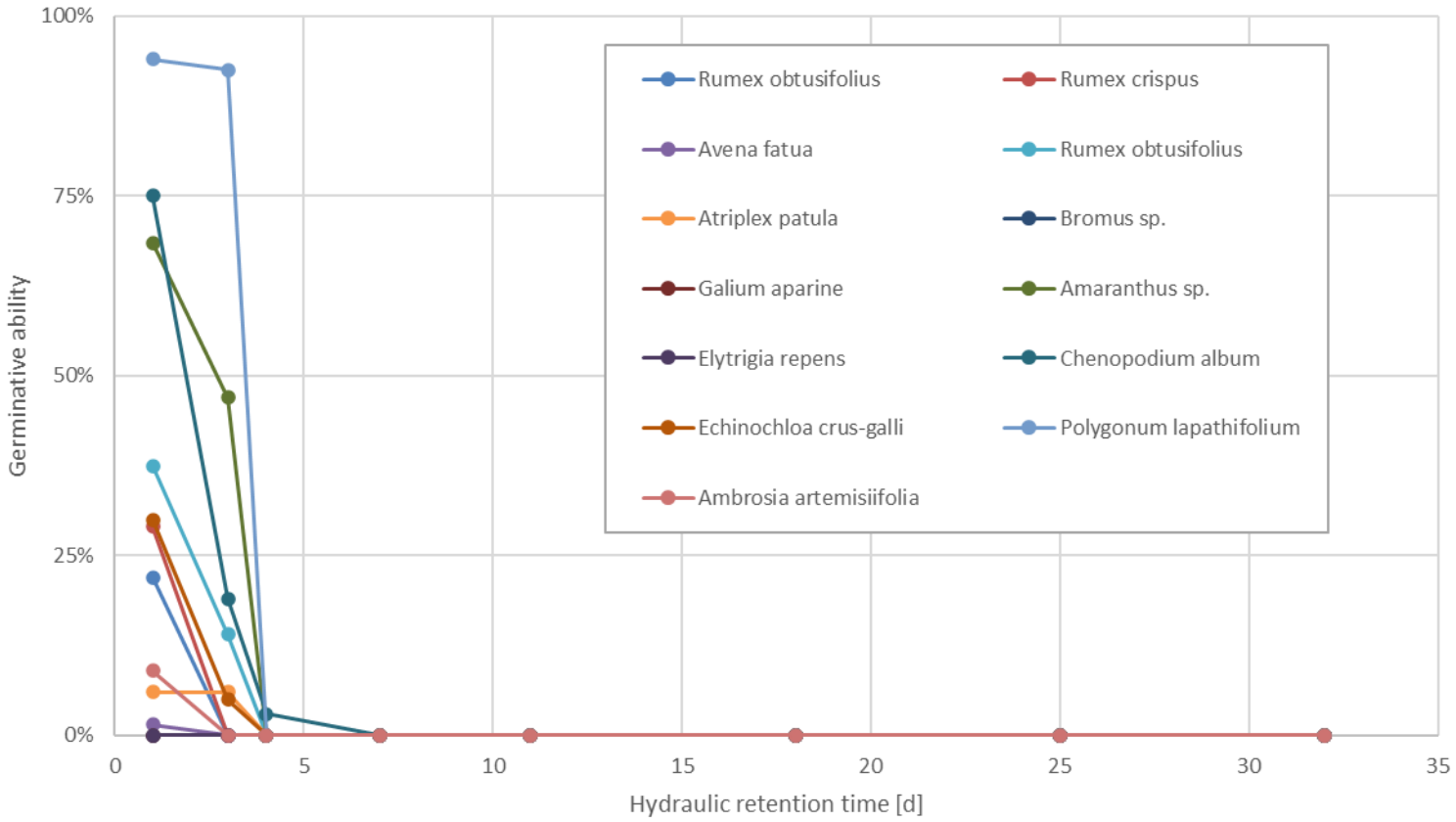

Simon, 2015

# Avoidable emissions by digestion of manure/slurry (incl. replacement of fossil oel)



# Weed seeds

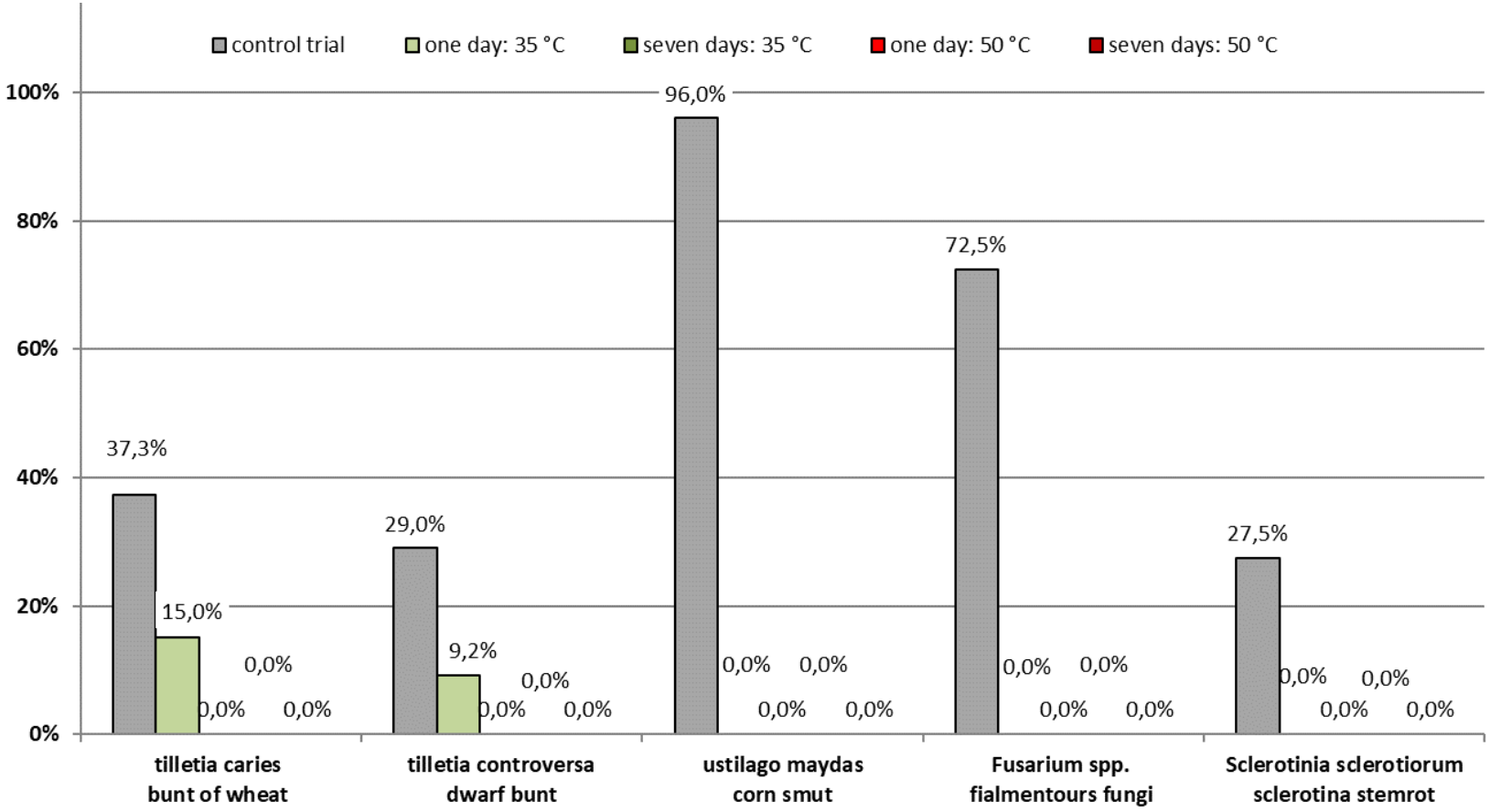
- Within a few days in the digester (mesophilic), there is a strong decrease and ultimately a complete loss of the ability to germinate




Sonnleitner & Sonnleitner, 2003; Gansberger, 2010

# Plant diseases

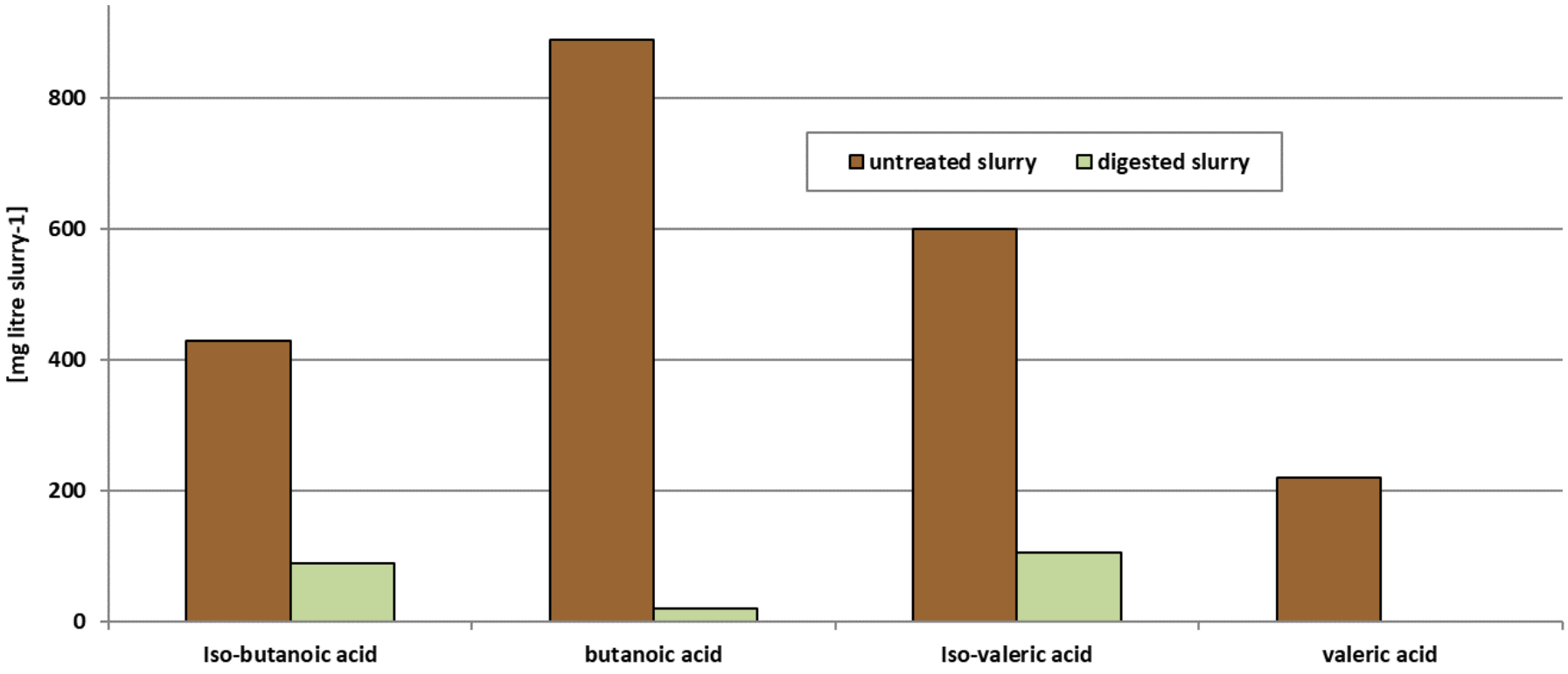
- The fungal pathogens were completely sanitized within hours resp. a couple of days




Leonhardt et al., 2010

# Odor

- Digested slurry has a significantly lower content of substances that are responsible for odor emissions



# Digestate - contents

- Investigation results of digestate (EBA)

| | unit | n | 10 % quantil | arithmetic average | 90 % quantil |
|---|---|---|---|---|---|
| DM content | [%] | 2137 | 2,8 | 5,8 | 9,1 |
| organic matte | [%] | 1926 | 55,2 | 68,9 | 82,2 |
| C/N | | 1656 | 1,9 : 1 | 5,0 : 1 | 9,4 : 1 |
| ph value | | 1922 | 7,5 | 7,9 | 8,3 |
| N total | [% of DM] | 1857 | 4,9 | 10,4 | 17,8 |
| NH4-N | [% of DM] | 2058 | 1,7 | 6,4 | 13,1 |
| K2O | [% of DM] | 1513 | 2,0 | 5,1 | 8,3 |
| P2O5 | [% of DM] | 1520 | 1,7 | 3,7 | 5,5 |
| CaO | [% of DM] | 1180 | 2,1 | 4,7 | 8,0 |
| Mg | [% of DM] | 1179 | 0,3 | 0,7 | 1,3 |

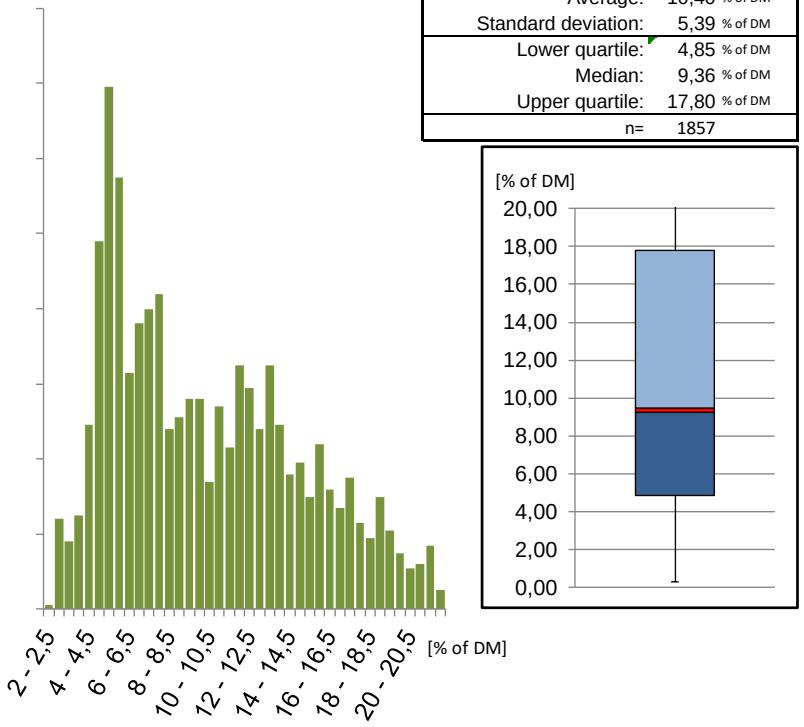
| | unit | n | 10 % quantil | arithmetic average | 90 % quantil |
|---|---|---|---|---|---|
| Cr | [mg/kg DM] | 1128 | 6,5 | 15,8 | 26,8 |
| Cd | [mg/kg DM] | 1102 | 0,2 | 0,4 | 0,6 |
| Pb | [mg/kg DM] | 1118 | 2,2 | 6,9 | 11,2 |
| Zn | [mg/kg DM] | 1133 | 160,0 | 332,0 | 530,0 |
| Cu | [mg/kg DM] | 1134 | 35,0 | 94,7 | 177,7 |
| Hg | [mg/kg DM] | 1098 | 0,0 | 0,1 | 0,2 |
| Ni | [mg/kg DM] | 1129 | 5,5 | 14,0 | 25,0 |
| Sn | [mg/kg DM] | 10 | - | 0,2 | - |
| Fe | [mg/kg DM] | 44 | - | 459,0 | - |
| Mn | [mg/kg DM] | 45 | - | 12,2 | - |

# Digestate - contents

- Investigation results of digestate (EBA)

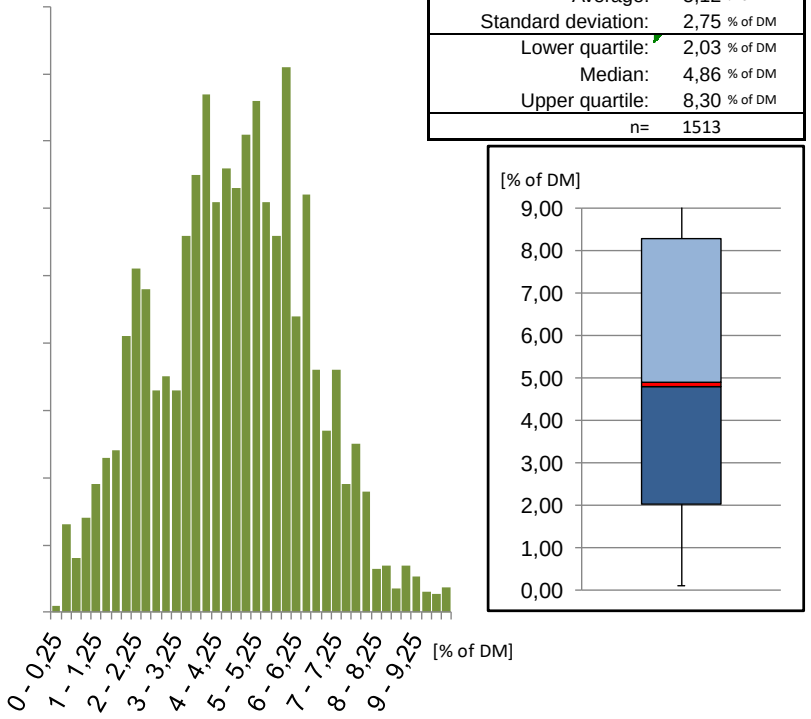
**Nitrogen**

| | |
|---|---|
| Average: | 10,40 % of DM |
| Standard deviation: | 5,39 % of DM |
| Lower quartile: | 4,85 % of DM |
| Median: | 9,36 % of DM |
| Upper quartile: | 17,80 % of DM |
| n= | 1857 |



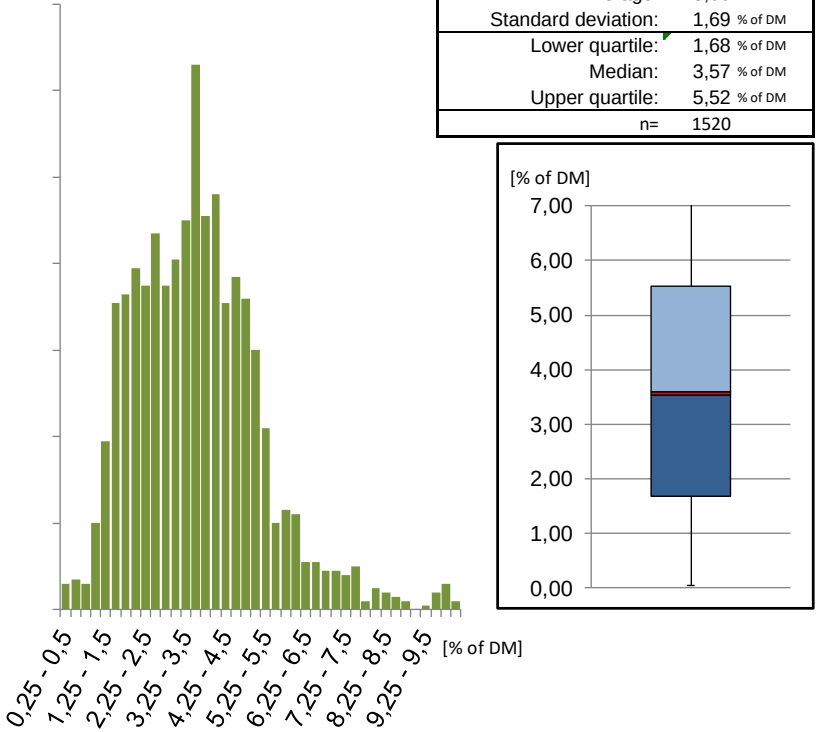

**Potassium (K2O)**

| | |
|---|---|
| Average: | 5,12 % of DM |
| Standard deviation: | 2,75 % of DM |
| Lower quartile: | 2,03 % of DM |
| Median: | 4,86 % of DM |
| Upper quartile: | 8,30 % of DM |
| n= | 1513 |




**Phosphor (P2O5)**

| | |
|---|---|
| Average: | 3,66 % of DM |
| Standard deviation: | 1,69 % of DM |
| Lower quartile: | 1,68 % of DM |
| Median: | 3,57 % of DM |
| Upper quartile: | 5,52 % of DM |
| n= | 1520 |



# $NH_3$-Emissions

- In 2016, all EU member states passed reduction commitments for fine particulate emissions (Directive (EU) 2016/2284)
- Agriculture is significantly affected by the nitrogen compound ammonia ($NH_3$). Austria: -12% by 2030 compared to 2005
- Reduction by
  - Anaerobic digestion
  - Optimization of the timing of digestate application
  - Low-lying digestate application
- Attention on chemical balance! $NH_4^+ + OH^- \rightleftharpoons NH_3 + H_2O$

63% of $N_{tot}$

# Digestate Storage

Pictures: Stürmer

# Digestate Application (Drag hose)


Drag hose:
-40% $NH_3$ emissions comp. to wide spreader

Bachmaier, 2021

Pictures: Hummel

# Digestate Application (Slurry injector)

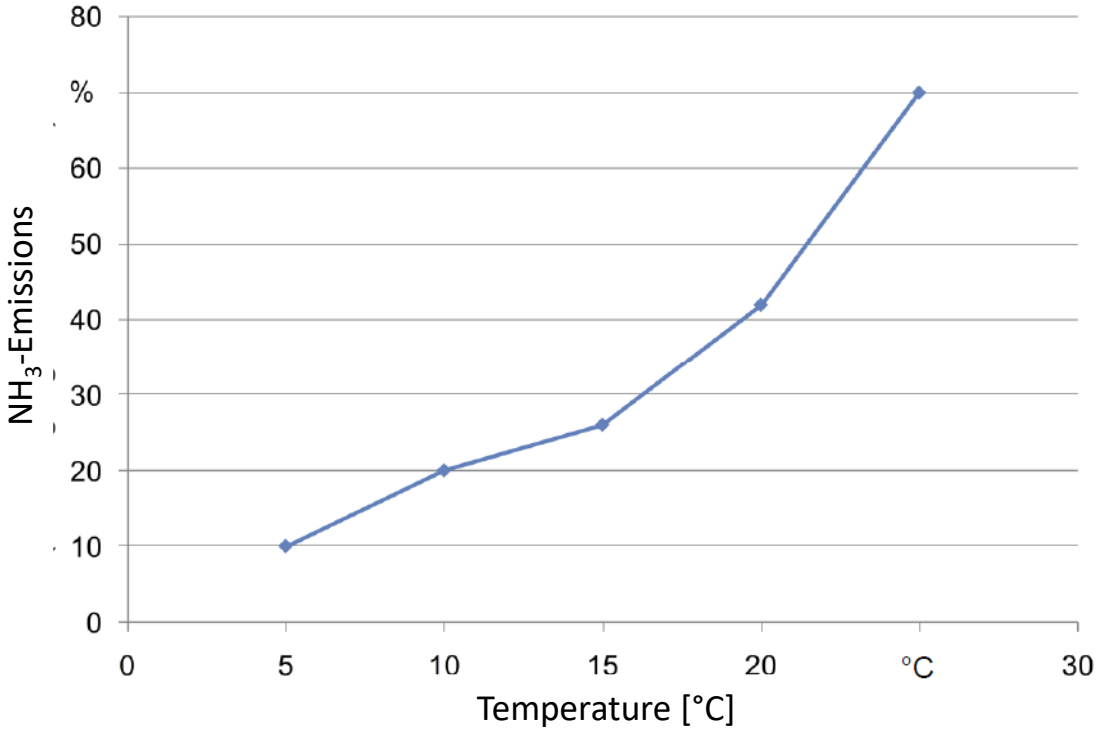

Soil cultivation within 1 hour: -85% $NH_3$ emissions comp. to wide spreader

Bachmaier, 2021

Pictures: Prieler

# Digestate Application – $NH_3$-Emissions

## $NH_3$-Emissions (wide spreader)




## Emission reduction

Optimization of the timing of digestate application can lower $NH_3$ emission significantly

Bachmaier, 2021; UBA, 2017

# Thank you for your Attention!

Dr. Bernhard Stürmer

Austrian Compost and Biogas Association

stuermer@kompost-biogas.info


https://dibicoo.org/

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