



UNIVERSITY OF  
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# Fertilisers from legumes and recycled waste products for cabbage, spinach and winter wheat

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# Introduction



## Problem?

Organic horticulture works without animal husbandry, therefore strongly dependent on external commercial fertilisers

- Contentious inputs from conventional farming e.g. feather meals, pig bristles or manure from intensive conventional animal husbandry
- Some products from conventional origin (e.g. vinasse) may contain contaminations with plant protection products
- Risk of nutrient imbalances: nutrient outputs via harvested products  $\neq$  nutrient inputs of the fertilisers: risk of K depletion and excess P inputs



Alternatives needed: N sources from within farm + external fertilisers that are „non-contentious“

# Introduction



## Solutions?

- **Clover-grass based fertilisers** from the farm itself or from other sources (vegan, of organic origin)



- **Biogas digestates** from organic origin or from household waste (closing rural urban nutrient cycles)



- **Residues** from (organic) **food industries**: e.g. Tofu whey (vegan, of organic origin)



# Material & Methods - 2019



**Two experimental years (2019 and 2020) with a two year crop rotation  
→ system approach**

- **Crop rotation (varieties):**
  - Early white cabbage for direct consumption (Amazon F1)
  - Spinach (Eagle RZ F1)
  - Winter wheat – baking (KWS Livius)
- **8 treatments/fertilisers (Fertiliser requirements of cabbage: 220 kg N ha<sup>-1</sup>):**
  - Control (no fertilisation)
  - Horn grit
  - Silage
  - Clover pellets
  - Biogas digestate (clover grass-pig slurry)
  - Tofu whey
  - Farmyard manure
  - Biogas digestates (biowaste)

# Fertilisers – Nutrient content (2019)



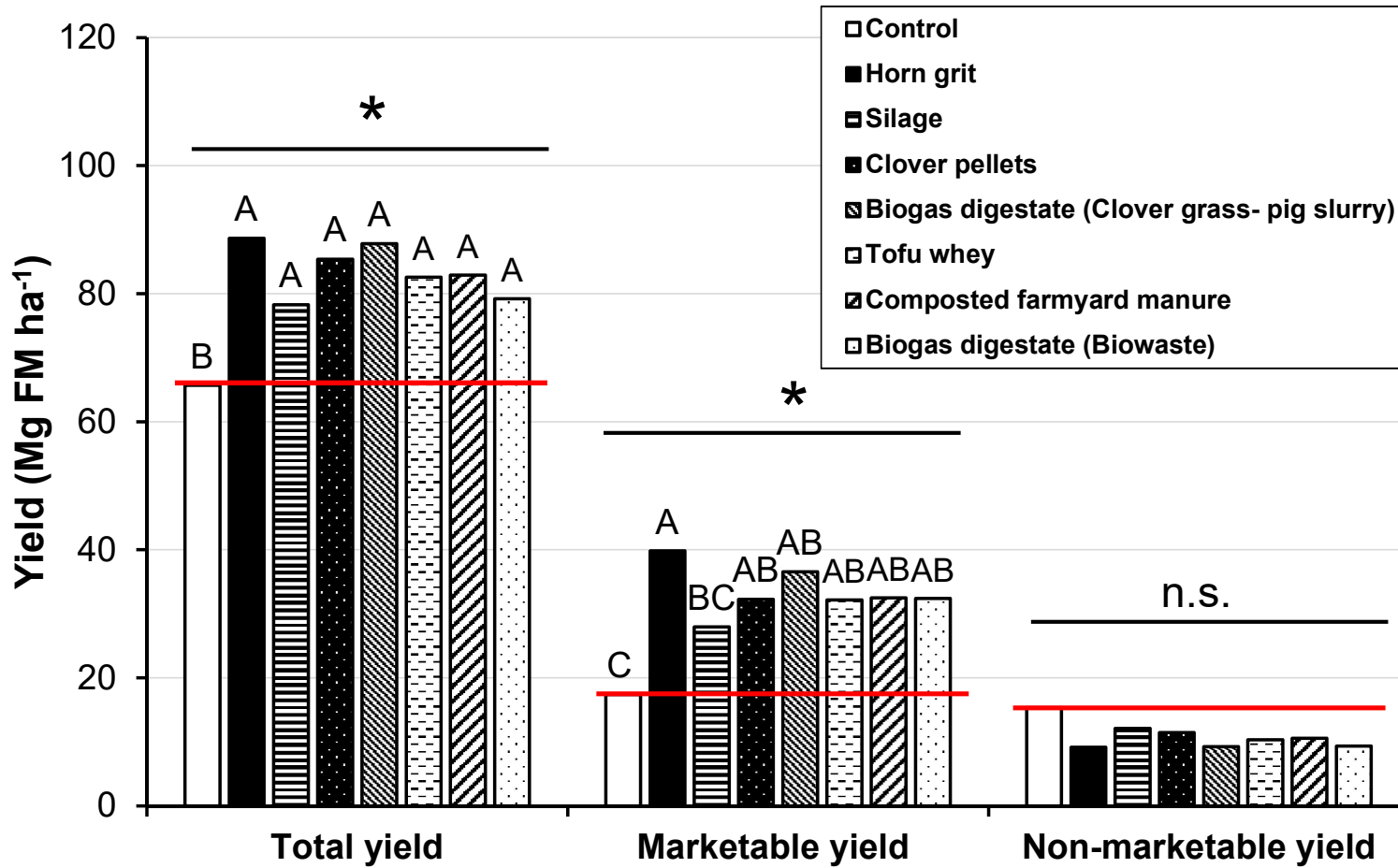
	<b>C</b> (% DM)	<b>N</b> (% DM)	<b>S</b> (% DM)	<b>Ca</b> mg kg <sup>-1</sup>	<b>K</b> mg kg <sup>-1</sup>	<b>Mg</b> mg kg <sup>-1</sup>	<b>P</b> mg kg <sup>-1</sup>	<b>C:N</b> Ratio	<b>TS</b> %
Tofu whey*	39.5	6.31	1.10	4512	14444	759	1463	6.4	<b>2.24</b>
Silage (clover gras)	40.3	2.64	0.15	5114	16327	2674	3278	<b>15.3</b>	51.12
Clover pellets	42.6	3.31	0.18	4074	16638	1810	3313	12.9	92.79
Biogas digestate (biowaste)	<b>27.9</b>	2.63	0.44	4079	15459	1753	3428	10.6	8.43
Biogas digestate (clover gras-pig slurry)	36.2	3.17	0.50	4013	16321	1796	3538	11.4	8.71
Composted farmyard manure	34.7	3.08	0.68	<b>23367</b>	<b>32529</b>	<b>7253</b>	<b>10520</b>	11.3	22.04
Horn grit	45.1	<b>14.7</b>	1.88	3813	15186	1907	3408	3.1	91.32

\*Average of 2 Tofu whey samples

Values of Ca, K, Mg, P are based on DM (after freeze-drying)

# Results – Early white cabbage

Marketable yield: Heads > 1kg  
 Non-marketable yield: Heads < 1kg

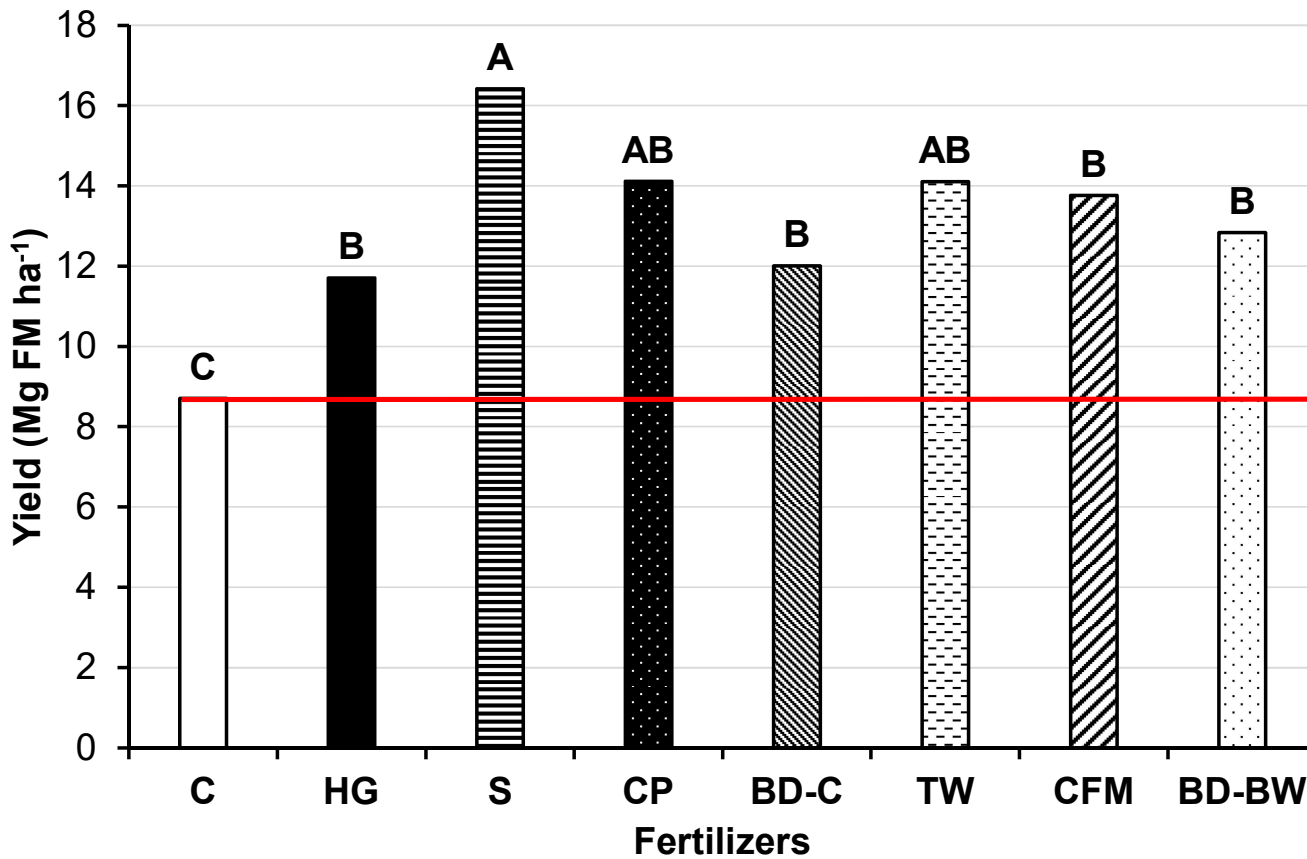


Different letters indicate significant differences for treatment for P < 0.05.

\*: p>0.05; \*\*: p>0.01; \*\*\*: p>0.001; n.s.: not significant



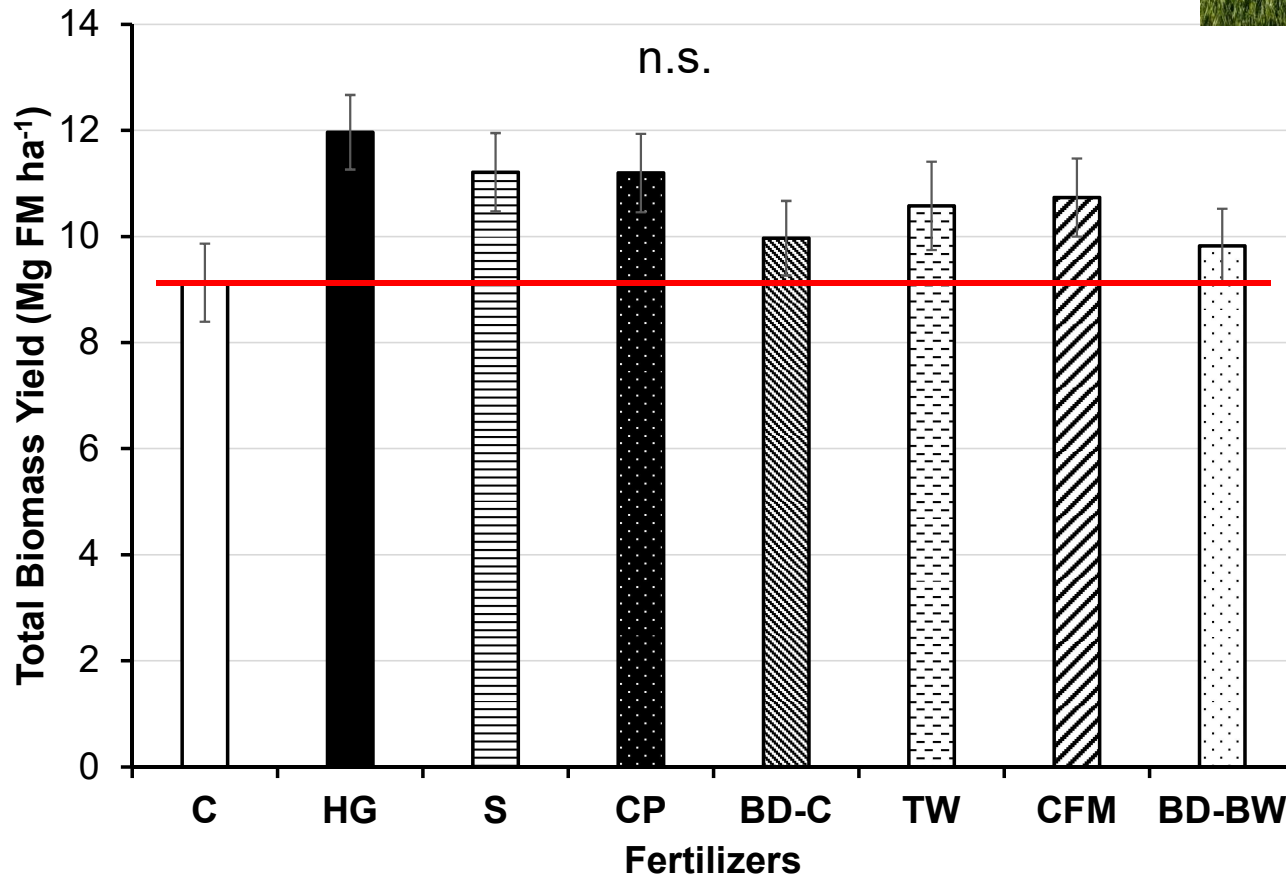
# Results - Spinach



<b>C</b>	Control - no fertilization
<b>HG</b>	Horn grit
<b>S</b>	Silage
<b>CP</b>	Clover pellets
<b>BD-C</b>	Biogas digestate – Clover grass-pig slurry
<b>TW</b>	Tofu whey
<b>CFM</b>	Composted farmyard manure
<b>BD-BW</b>	Biogas digestate - Biowaste

Different letters indicate significant differences for treatment (lower case) for P < 0.05.

# Results – Winter wheat



Error bars: Standard error; n.s.: not significant



<b>C</b>	Control - no fertilization
<b>HG</b>	Horn grit
<b>S</b>	Silage
<b>CP</b>	Clover pellets
<b>BD-C</b>	Biogas digestate – Clover grass-pig slurry
<b>TW</b>	Tofu whey
<b>CFM</b>	Composted farmyard manure
<b>BD-BW</b>	Biogas digestate - Biowaste



# Conclusions



## First preliminary results

- fertilisers are suitable alternative fertilisers for organic horticulture without high yield losses (compared to horn grit)
- Clover pellets and biogas digestates of clover grass and pig slurry are most promising alternative fertilizers

→ Verification by the second experimental year

→ Detailed evaluation of plant and soil analysis necessary

## Problems:

- **Clover pellets** – How high are the costs? Is it worth to buy it? 1 kg N → ~81€ (Horn grit ~12€ per kg N)
- **Tofu whey** – Is it worth to transport all the water? Possibilities to reduce the liquid fraction without losing nutrients?
- **Biogas digestates of biowaste** – In Germany → EU-Organic Certification needed!!!



