UNIVERSITY OF HOHENHEIM

HAUPT- UND LANDGESTÜT Marbach

NGU Nürtingen-Geislingen University | Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen

Composting as a sustainable way of utilization of horse manure

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Utilization of horse manure - challenges

- high amount of horse manure ~ 14.3 million tpa in Germany
- increasing government requirements
- limited suitability of horse manure as fertilizer without pre-treatment (especially for grassland)
  - containing high percentage of straw
    - slow decomposition
  - unclear hygienic status
    - risk of reinfection with various pathogens
    - may containing pharmaceutic residues

source: own picture

Utilization of horse manure - challenges

- occasionally low demand for horse manure and potential high cost for disposal
- closing of nutrient cycles and alternative organic fertilizers are increasingly in focus

chance for rediscovery of horse manure as a valuable fertilizer

but an appropriate processing needed

Is composting a sustainable way to utilize horse manure from a **hygienic** point of view?

Research design

- eight trial runs
  - six weeks
  - summer and winter months
  - 2022-2024

source: own pictures

Table 1: treatment trial piles

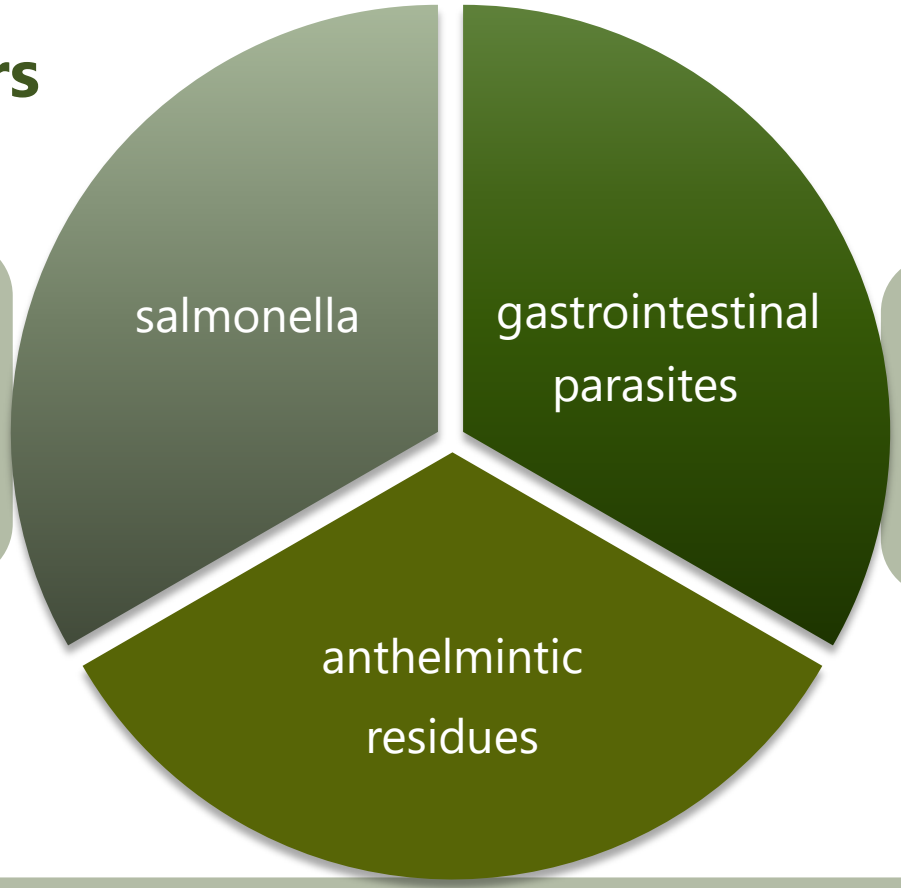
trial pile	treatment start	treatment after three weeks
1	X	X
2	chopped	X
3	chopped	turned over
4	chopped	chopped

source: own figure

Examination parameters

- 60 samples in trial piles
- 2 control samples stored at 4 °C

- qualitative analysis: enrichment methods
- quantitative analysis: most probable number method (De Man)



- 60 samples in trial piles
- 2 control samples stored at 4 °C

- quantitative analysis: modified McMaster (Wetzel)

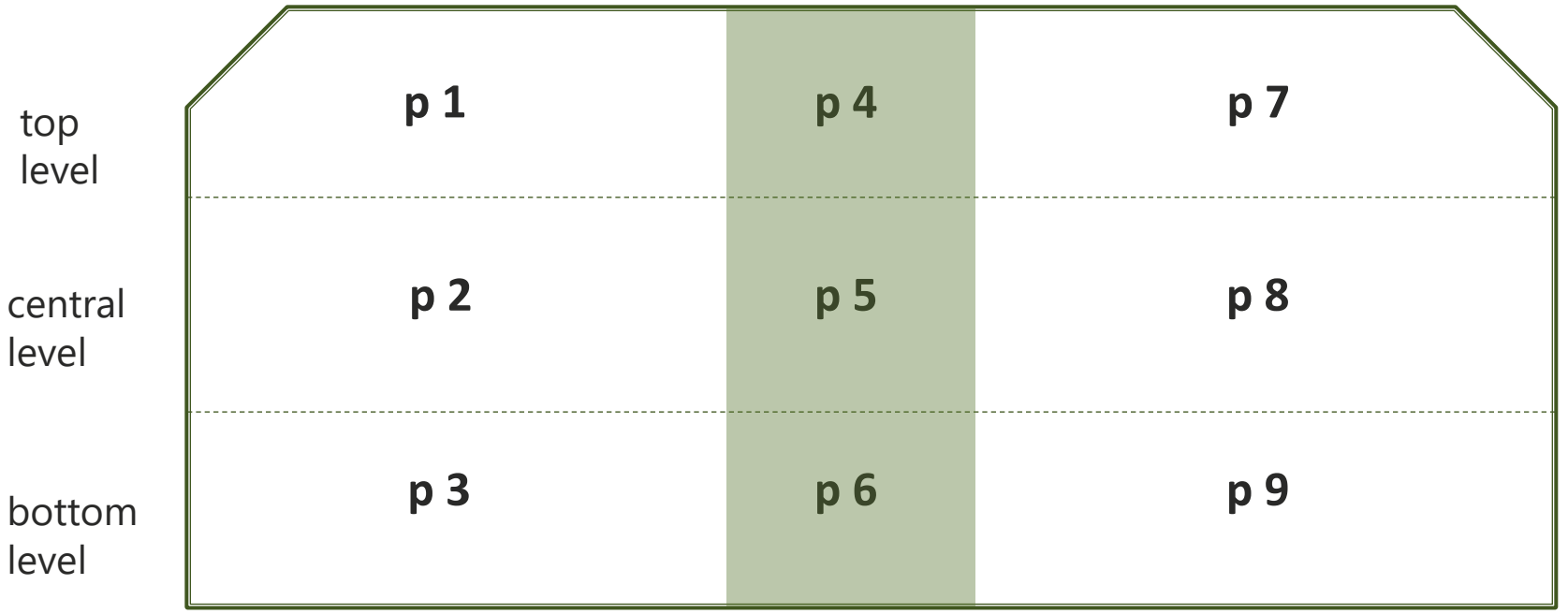
- 12 samples in trial piles
- 1 control sample stored at 4 °C

- analysis: newly developed method for detecting anthelmintic residues in horse faeces with mass spectrometry (to be published)

source: own figure

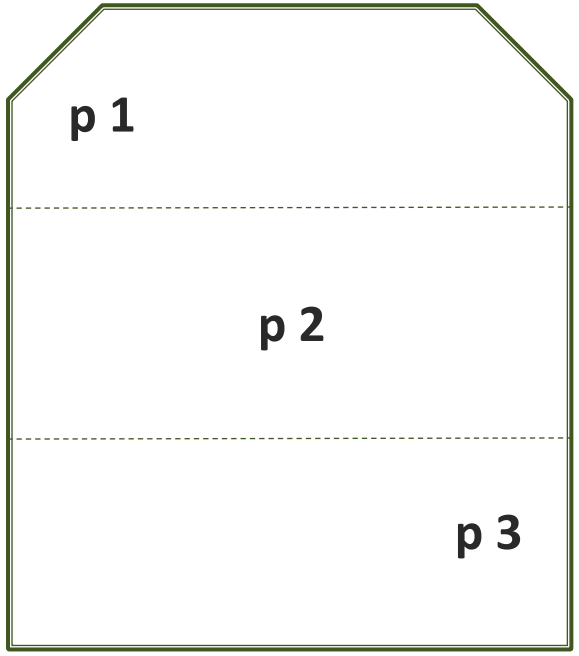
Sample position

side view trial pile



p = position in pile

front view trial pile



source: own figures

Sanitation of salmonella

successful sanitation = reduction by ≥5-log-levels

Table 2: Reduction of salmonella after six weeks of composting

pile/ position	trial 4	trial 6	pile/ position	trial 4	trial 6
1/1	✓	✓	3/1	✓	✓
1/2	✓	✓	3/2	✓	✓
1/3	X	X	3/3	X	✓
1/4	✓	✓	3/4	✓	✓
1/5	✓	✓	3/5	✓	✓
1/6	X	X	3/6	✓	✓
1/7	✓	✓	3/7	✓	✓
1/8	✓	✓	3/8	✓	✓
1/9	X	✓	3/9	✓	✓
2/1	✓	✓	4/1	✓	✓
2/2	✓	✓	4/2	✓	✓
2/3	✓	✓	4/3	X	✓
2/4	✓	✓	4/4	✓	✓
2/5	✓	✓	4/5	✓	✓
2/6	X	✓	4/6	✓	✓
2/7	✓	✓	4/7	✓	✓
2/8	✓	✓	4/8	✓	✓
2/9	X	✓	4/9	✓	✓

✓= reduction by ≤5-log-levels, X= reduction by >5-log-levels

source: own figure

t 4= winter, t 6= summer

- treatment variants
  - significantly **more often** a successful sanitation in **pile 2, 3** and **4 (chopped)** than in **pile 1 (untreated)**
  - **no** significant differences between **piles 2, 3,** and **4**
- pile levels
  - significantly **more often** a successful sanitation at the **top level** and the **central level** of the piles than at the **bottom level (p 3,6,9)**
  - **no** significant difference between the **top** and **central level**
- seasonal differences
  - significantly **more often** a successful sanitation in **summer trials** than in **winter trials**

Sanitation of salmonella

successful sanitation = reduction by ≥5-log-levels

Table 3: Reduction of salmonella after **changing position** after three weeks

pile/ position	trial 4	trial 6
3/1.1	✓	✓
3/2.1	✓	✓
3/3.1	✓	✓
3/4.1	✓	✓
3/5.1	✓	✓
3/6.1	✓	✓
4/1.1	✓	✓
4/2.1	✓	✓
4/3.1	✓	✓
4/4.1	✓	✓
4/5.1	✓	✓
4/6.1	✓	✓

source: own figure

✓= reduction by ≥5-log-levels, **X**= reduction by <5-log-levels
t 4= winter, t 6= summer

- position change
  - significantly **more often** a successful sanitation when samples **changed position**
- composting time
  - significantly **more often** a successful sanitation after six weeks than after three weeks of composting

Gastrointestinal parasites

- significant decrease in parasite eggs after composting noticeable

- observations similar to salmonella concerning potential influencing factors
  - treatment variants
  - position in the pile and change of position
  - composting time
  - climate conditions

- unclear
  - whether the remaining eggs are still infectious
  - what happened to the eggs that could no longer be detected

source: own picture

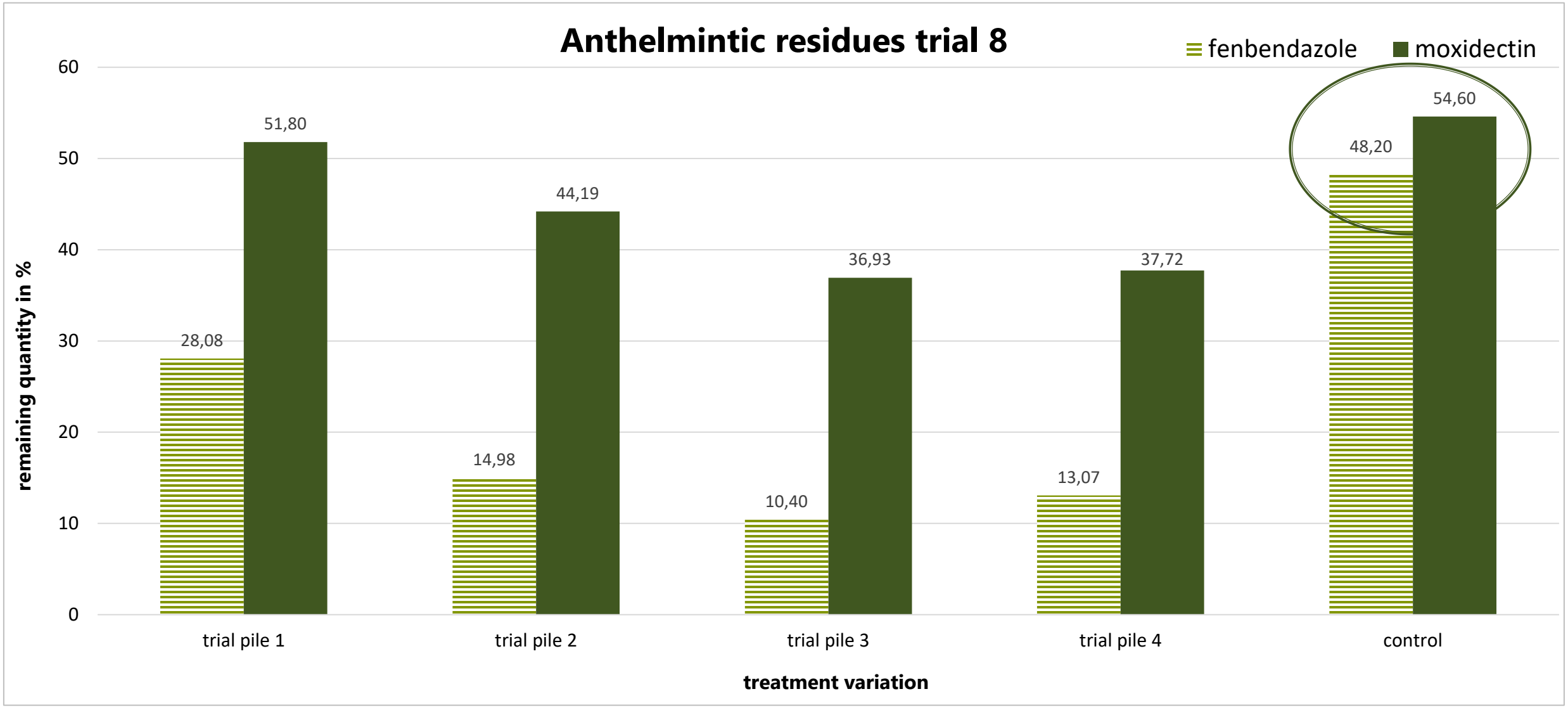


Figure 1: Residues of anthelmintic in form of fenbendazole and moxidectin

source: own figure

Anthelmintic residues

Hypothesis:

- factors such as temperature within the pile as well as climate conditions have varying influence on the degradation behavior of different anthelmintics
  (in addition to their natural degradation process)

further analysis, tests and more data are necessary to verify the initial results

Conclusion

From a **hygienic** point of view, composting can be a sustainable way of utilization of horse manure, if it is done the right way!

source: own picture

Recommendations

Optimizing of composting process of horse manure

- reducing the percentage of bedding, straw better than shavings
- consideration of C:N ratio (approx. 25:1)
- chopping before composting and homogenization of material
- turning over of manure pile
- allow sufficient composting time
- watering (approx. 60% moisture) or covering, if necessary

Thank you very much for your attention!

source: own picture

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Time for your questions!

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