



Digital Value Chains
for a Sustainable
Small-Scale Agriculture



UNIVERSITY OF
HOHENHEIM



Nürtingen
Geislingen
University



source: own picture

Determining animal welfare factors in horse husbandry through digital technology

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source: own picture

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Stable air factors requirements for horses

- The optimum stable climate is based on the constantly changing outdoor climate.
- 5-25°C, 60-80% relative humidity (horse exhales 300ml of water per hour)
- 5% of the stable as light surface (1m² / horse) 60-100 lux
- Sufficient room height for air volume (at least 2x withers), 30-40m³/horse (5 to 10 times as much oxygen as a human)

Air movement measurement



After 15min the smoke should be aired out

Air flow velocities
0.2 m/sec to 0.8 m/sec

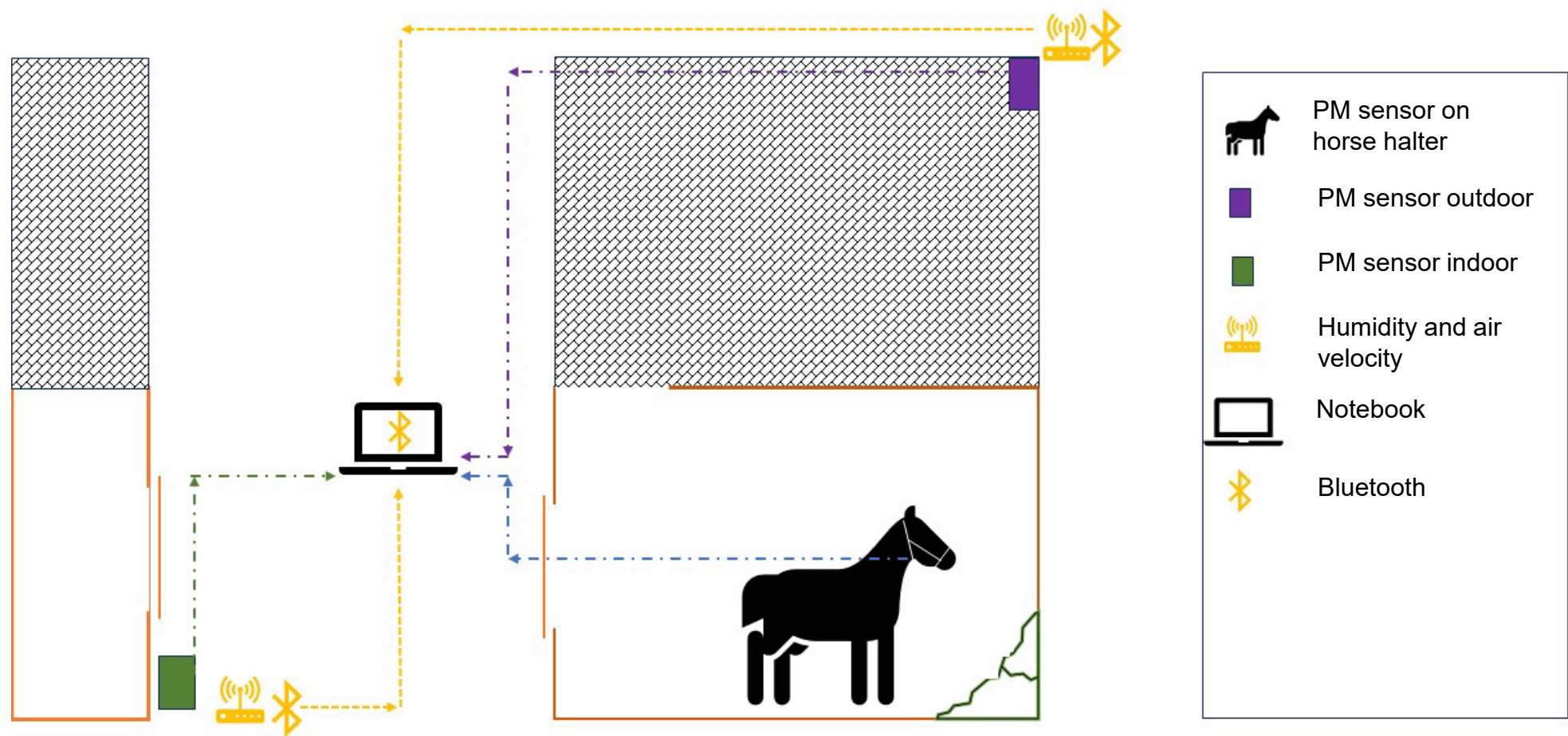




Dust in horse husbandry



Data acquisition – sensor location



Digital real time interaction of various sensors

source: own illustration

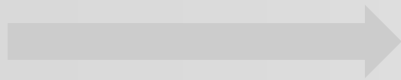
Data acquisition – sensor location



PM of steamed and not steamed hay



Hanging haynet: mesh size 3-6cm



Haynet ground: mesh size 6cm



Loose hay



Haysteaming



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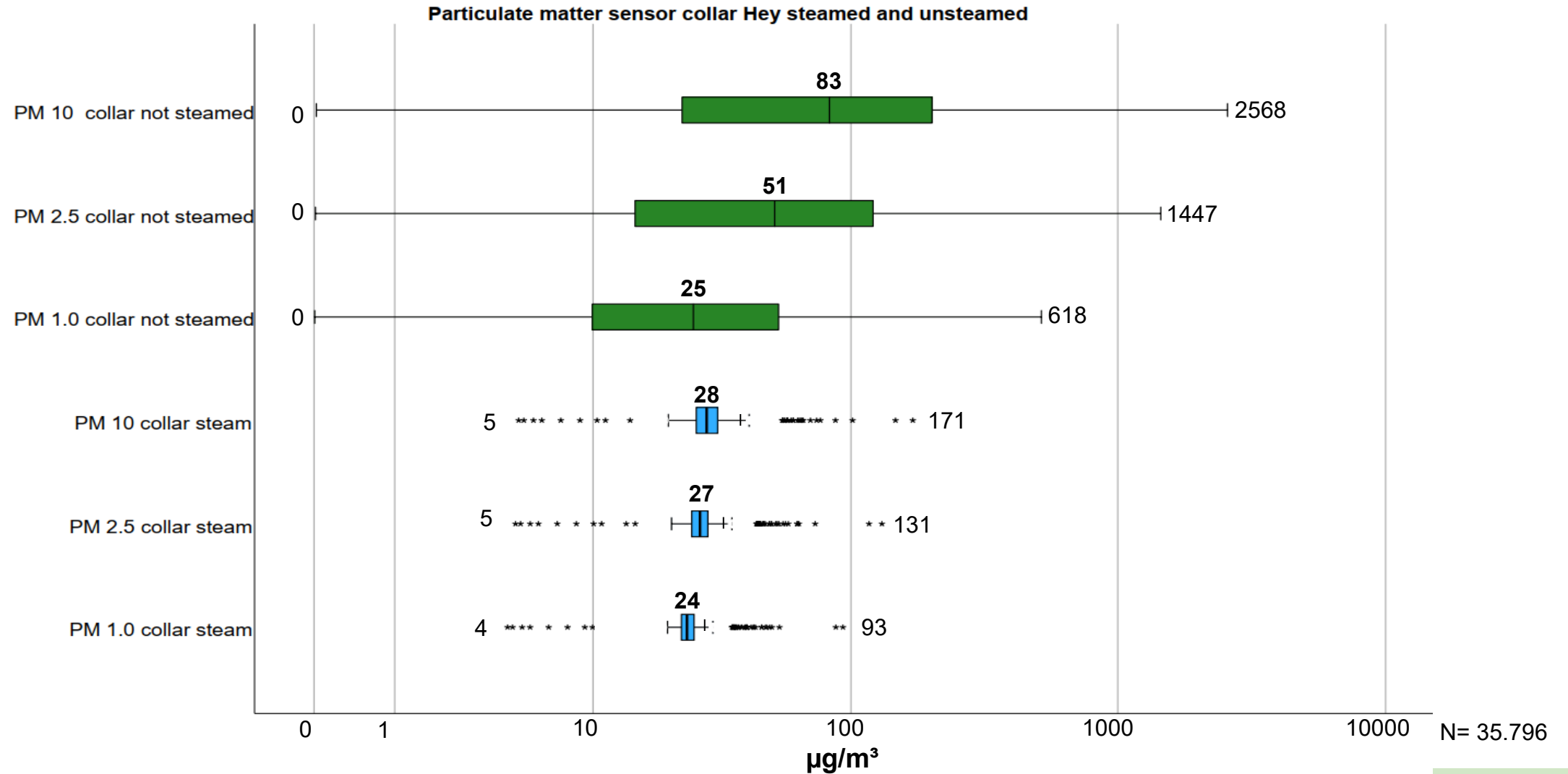
Analysis of hay and straw in relation to hygienic conditions 1-4 (LUFA NRW):

Description	aerobic mesophilic bacteria			mold and black fungi		yeasts	
	Enterobakt.	Bacillus spp	Streptomyce.	Schwärzep.	Aspergillen	Mucoraceen	
Hay round bale unsteamed	1	1	4	1	4	4	1
Hay round bale 3h steamed	1	1	1	1	1	1	1
Hay square bale unsteamed	2	1	1	2	1	1	4
Hay square bale 2h steamed	1	1	1	1	1	1	2
Straw round bale unsteamed	2	1	1	1	1	1	1
Straw round bale 2h steamed	1	1	1	1	1	1	1
Haylage unsteamed	2	1	1	3	4	1	4
Haylage 2,5h steamed	1	1	1	1	1	1	1

Source: Pferdebetrieb SSN 1437-3866

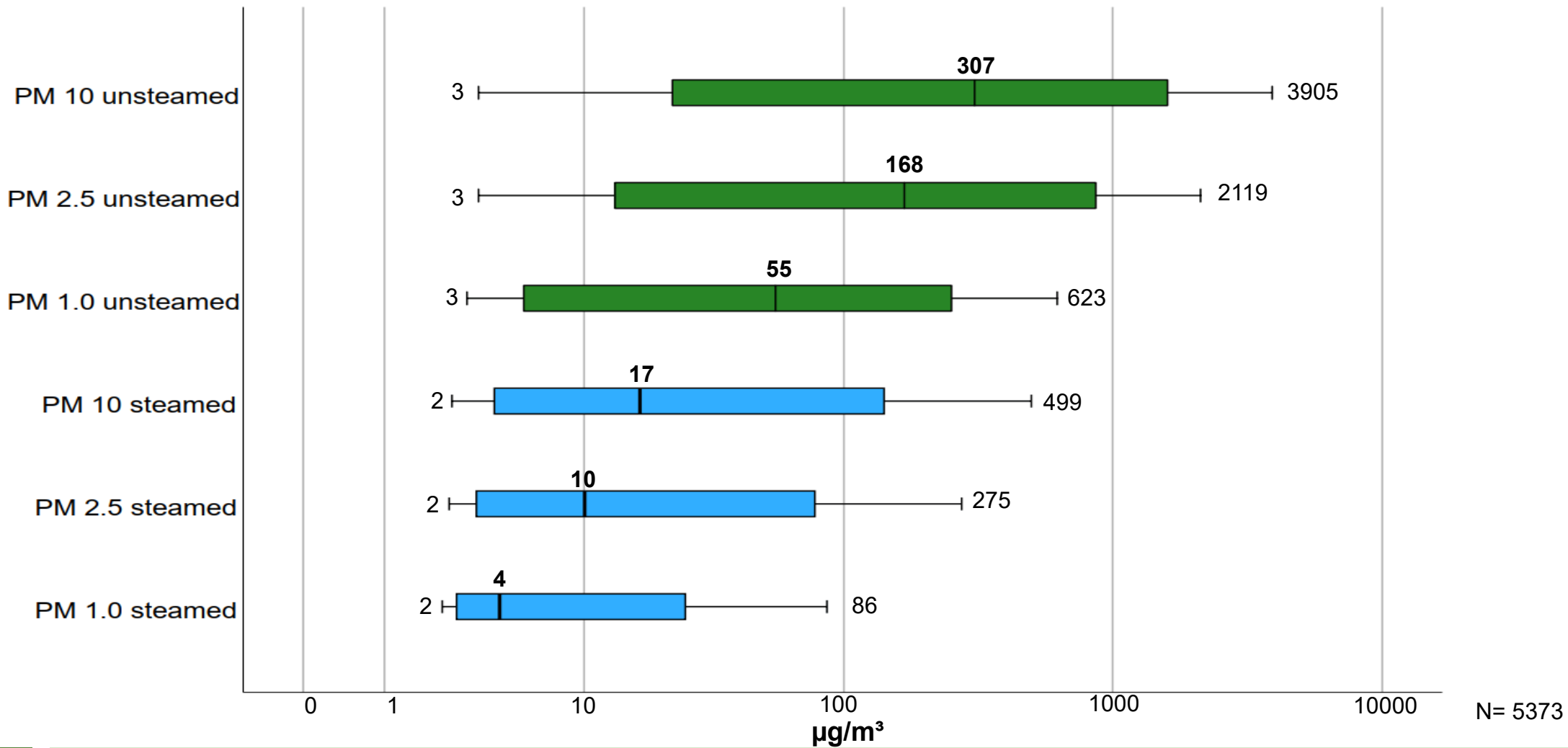


Results PM of steamed and not steamed hay - collar





Results PM Results straw, steamed and not steamed, measured in a horsebox by littering



Data collection - PM- test box





Data collection- PM- test box

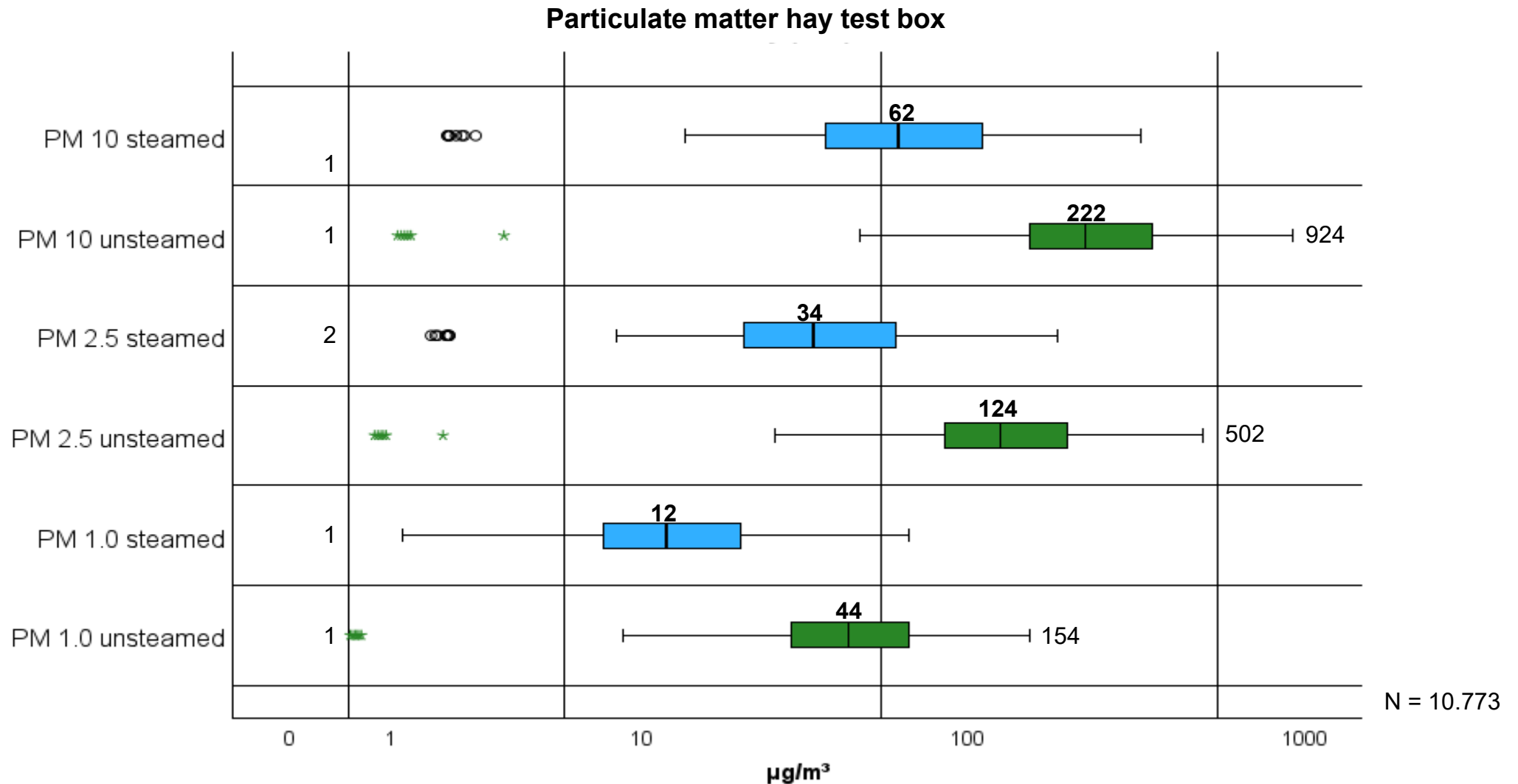
Material

- Straw and hay, steamed / not steamed
- Length: 15-35cm
- 300g per sample

Methods:

- 1x 90° crank movement to the left, then 90° to the right
- 4x pump strokes (900ml per piston stroke = 3600 ml)
- 3 samples (not steamed hay, steamed hay, not steamed wheat straw, steamed wheat straw)
- 3 cycles per sample (10 min measurement) per cycle
- Cleaning the box after each sample

Results PM steamed and not steamed hay - box





SUMMARY

- stable air factors are very important for horse and human health
- mobile data collection using sensor technology can help to record and evaluate the situation
- Steaming systems help to reduce the particulate matter concentration and biotic loads in the air



**Thank you for your attention,
and time for questions**



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