MastiMIR
MIR prediction for udder health

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Mastitis

When a cow has mastitis problems

- not only
  - **Milk yield** [kg/d] ↓
  - **SCC** [cells/ml] ↑
- but also the main milk components:
  - **Lactose** [%] ↓
  - **Protein** [%] ↑
  - **Fat/Lactose ratio** ↑
- this also applies to the milk fine components:
  - **Sodium** [mg/kg] ↑
  - **Lactoferrin** [µg/ml] ↑
  - **BHB betahydroxybuttyrate** [mmol/l] ↑

- produces economic losses
- Mastitis causes at least 26% of the total costs of all dairy cattle diseases
- Losses due to mastitis are usually twice as high as losses due to infertility and reproductive diseases.
- Economic sources of losses:
  - Reduced milk production
  - Milk not saleable
  - Cost of early cow replacement
  - Reduced cow sale value
  - Increased need for medicines
  - Veterinary services
  - Labour analysis

MastiMIR

Objective: Mastitis risk modelling throughout lactation based on **diagnostic data** from a health monitoring project (GMON) in Baden Württemberg and **observations** from farmers in Alsace.

Material and Methode:

- MIR spectral data from milk recording analysis:
  1 test sample / animal / month
- Animal-related data - Fix effects:
  - Breed
  - Parity
  - Sampling time
  - Lactation days
  - Milk yield groups

- Direct use of **MIR spectra** with **Legendre polynomial** correction
- Machine learning models: **CPPLS** and **GLMNET**

MastiMIR

1st Validation - spectrum selection
- 70% Calibration model
- 30% Validation model

2nd Validation - farm selection
- 70% Calibration Model
- 30% Validation model

3rd Validation
- 2017-2018 Production year data

SCC filter < 50,000 --> for healthy data

SCC filter >400,000 --> for non-healthy data

MastiMIR Model	Sensibility (non-healthy)	Specificity (healthy)
LKVBW - Model 2019		
Calibration SCC-Filter	85.6%	90.3%
1st Validation SCC-Filter	74.9%	90.4%
2nd Validation SCC-Filter	75.6%	83.3%
3rd Validation no SCC-Filter	63.9%	70.7%
Elsass - Model 2019		
Calibration no SCC-Filter	63.9%	74.1%
1st Validation no SCC-Filter	72.4%	68.6%
2nd Validation no SCC-Filter	64.6%	64.8%
3rd Validation no SCC-Filter	71.6%	66.2%
LKVAT - Model 2019		
Calibration no SCC-Filter	60.3%	71.6%
1st Validation no SCC-Filter	75.5%	71.4%
2nd Validation no SCC-Filter	73.6%	72.0%
3rd Validation no SCC-Filter	74.5%	71.3%

Intermediate conclusion

- **MastiMIR** can represent the risk of mastitis well and can complement the SCC classes.
- Compared to the SCC model, the MastiMIR model shows an earlier occurrence of the "slightly at risk" classification.

- It could help veterinarians and farmers:
  - in early detection
  - and better treatment

Next steps:

In Baden Württemberg:

- **Preparation of the MastiMIR reports**
- **Workshop for advisors of the LKV BW**

Team Work is our goal !!!

Regional selection of the farms

- Homogeneous regional distribution of farms
- 7 field workers spread over BW
- all main breeds covered

Selection of MastiMIR Pilot Farms

Selection criteria:

- **Robot farms**
- **Farms with somatic cell count problems**
- **Farms participating in PCR analysis of tank milk**
- **Farms with genetic analysis of milk (Genocell)**
- **Farms with mastitis problems**
- **Farms carrying out bacteriological analysis**

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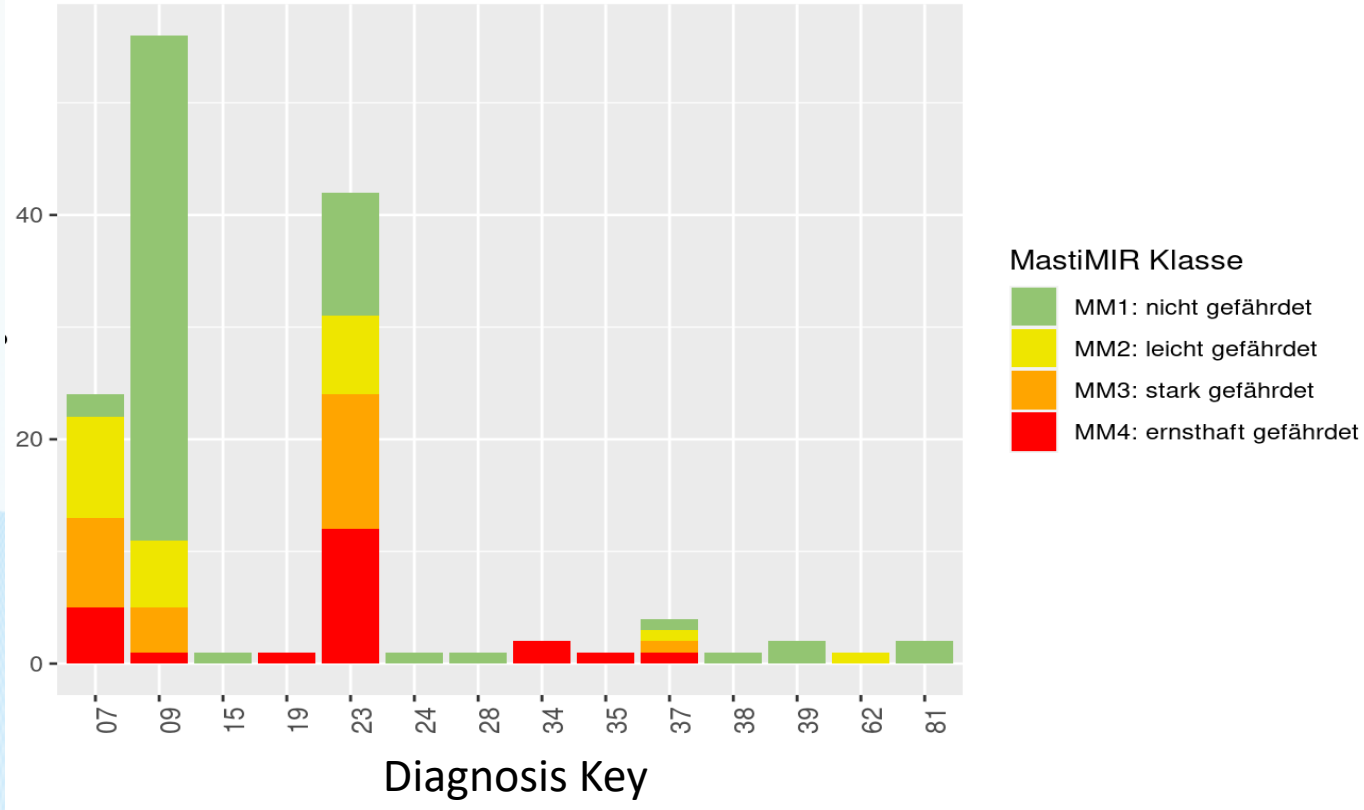
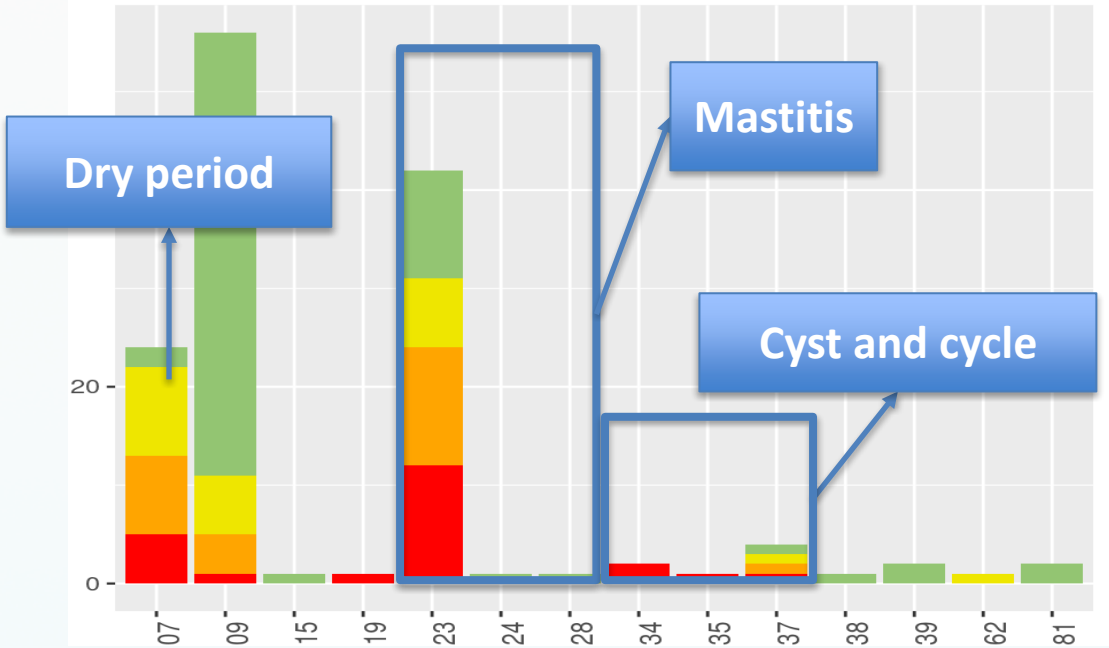
MastiMIR: LKV Baden-Württemberg – Vets Diagnosis

Diagnosis keys per Lactation Week



Diagnosis keys per Lactation Week



21	Udder abscess
22	Mastitis-chronic
23	Mastitis-acute
24	Mastitis-phlegmonosa (colimastitis)
25	Mastitis-apostematosa (Pyogenes germs)
26	Mastitis-subclinical
27	Teat/udder lesions
28	Milking disorders- heavy, long milkers
29	Other (udder diseases)

MastiMIR: LKV Baden-Württemberg – Observations from field workers or farmers

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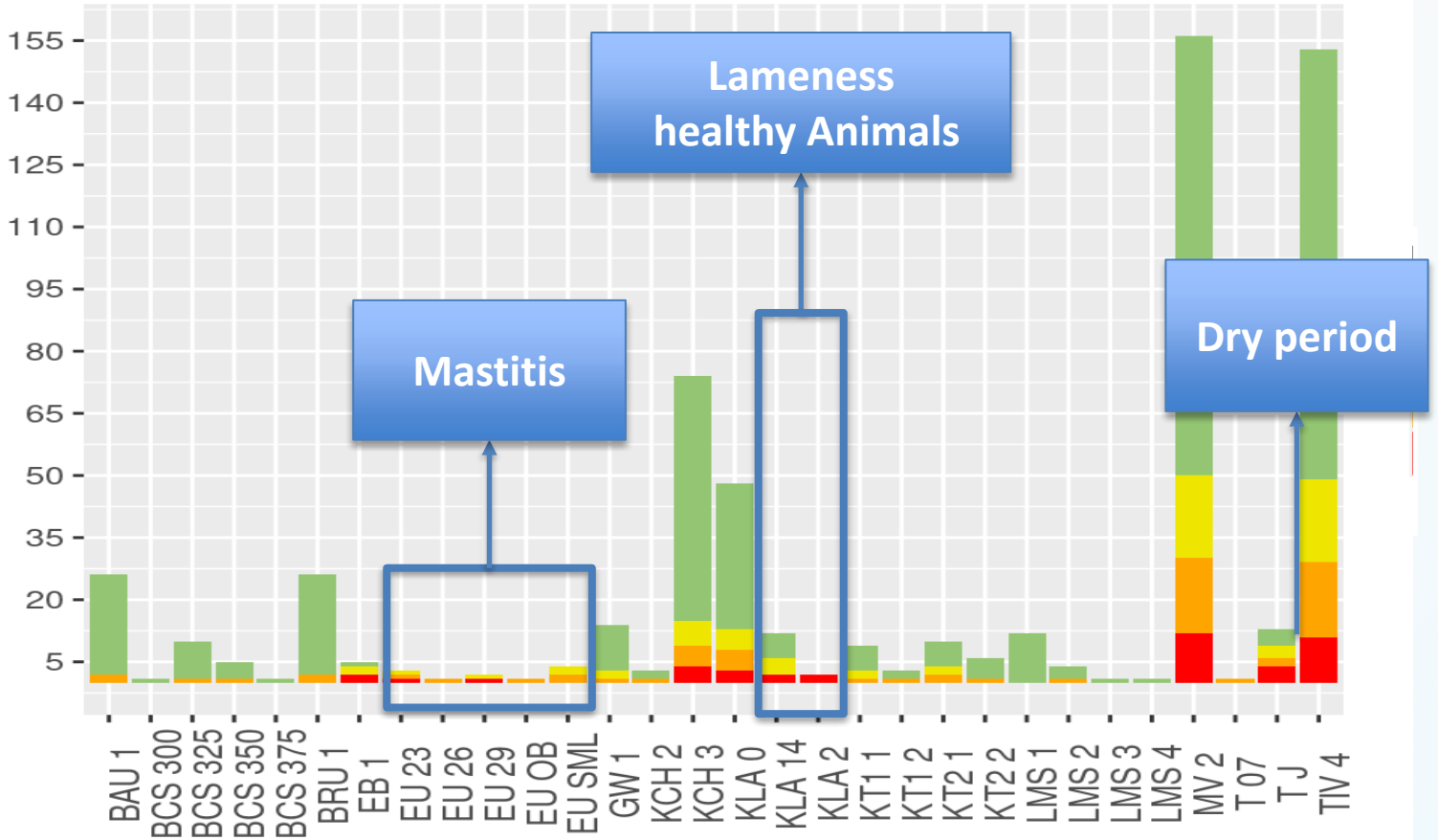
Observations keys per Lactation Week



Observation Key

Intermediate conclusion

- Feedback farmer and field workers observed frequently animals that are apparently false positives.
  - ➢ Therefore, additional bacteriological analysis have been carried out since July 2022.
  - ➢ To identify red animals in the MastiMIR report that are sick (subclinical) despite the farmer's or field workers statement.

LANDESVERBAND BADEN - WÜRTTEMBERG
FÜR LEISTUNGS- UND QUALITÄTSPRÜFUNGEN IN DER TIERZUCHT E. V. (LKV)

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MastiMIR - Einzeltiere Berateransicht

Testbetrieb 175818 Gebiet: 3106 Probedatum: 19.09.2022

Erich Kemmner, Esslinger Weg 1, 72669 Unterensingen

Erläuterungen zur Tabelle:

Rasse = Rasse, **L-Nr** = Laktationszahl, **L-Tage** = Laktationstage
Mkg = Milch Menge Tag [kg], **ZZ** = Zellzahl [zellzahl/ml],
L% = Laktose [%], **Na** = Natrium [mg/kg], **K** = Kalium [mg/kg],
Ka = Kalzium [mg/kg], **KaBlut** = Blut Kalzium [mmol/L],
Lactoferrin = Lactoferrin [mg/L], **BHB** = Beta-Hydroxybutyrat [mmol/L]
BHBBlut = Blut Beta-Hydroxybutyrat [mmol/L]

MastiMIR

MMI: MastiMIR Index (1-100) (durchschnittliche Genauigkeit 85%)

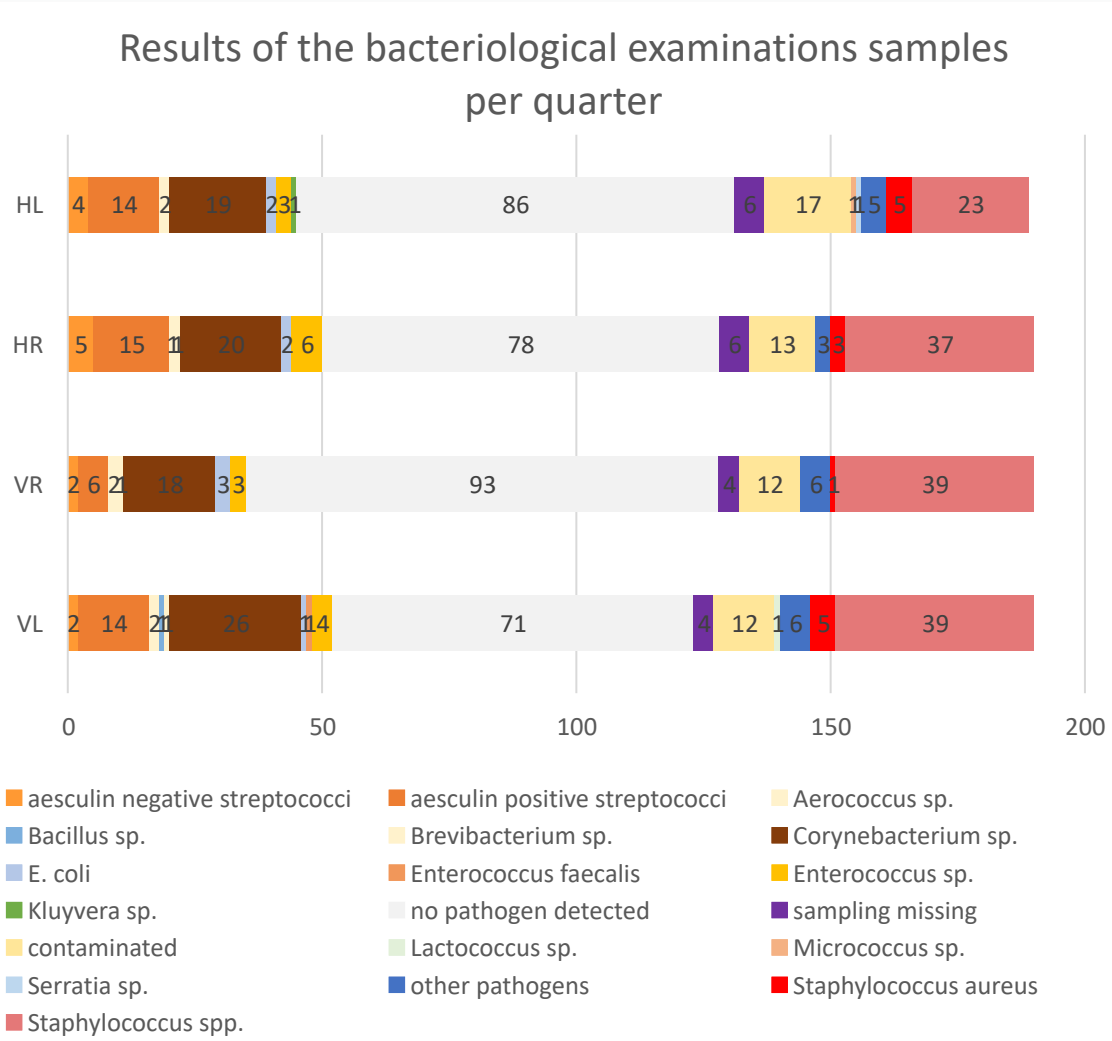
Farben: MastiMIR-Klassen 1 - 4 mit Indexgrenzwerten:
1. MM1: nicht gefährdet - Indexgrenzen: 1 - 50
2. MM2: leicht gefährdet - Indexgrenzen: 50 - 65
3. MM3: stark gefährdet - Indexgrenzen: 65 - 85
4. MM4: ernsthaft gefährdet - Indexgrenzen: 85 - 100

Lactoferrin<50 Wert nicht aussagekräftig
Lactoferrin>400 dennoch ist Tier leicht oder nicht gefährdet
ZZ<50 dennoch ist Tier ernsthaft oder stark gefährdet
ZZ>1500 dennoch ist Tier leicht oder nicht gefährdet
L-Tage<15 dennoch ist Tier ernsthaft oder stark gefährdet

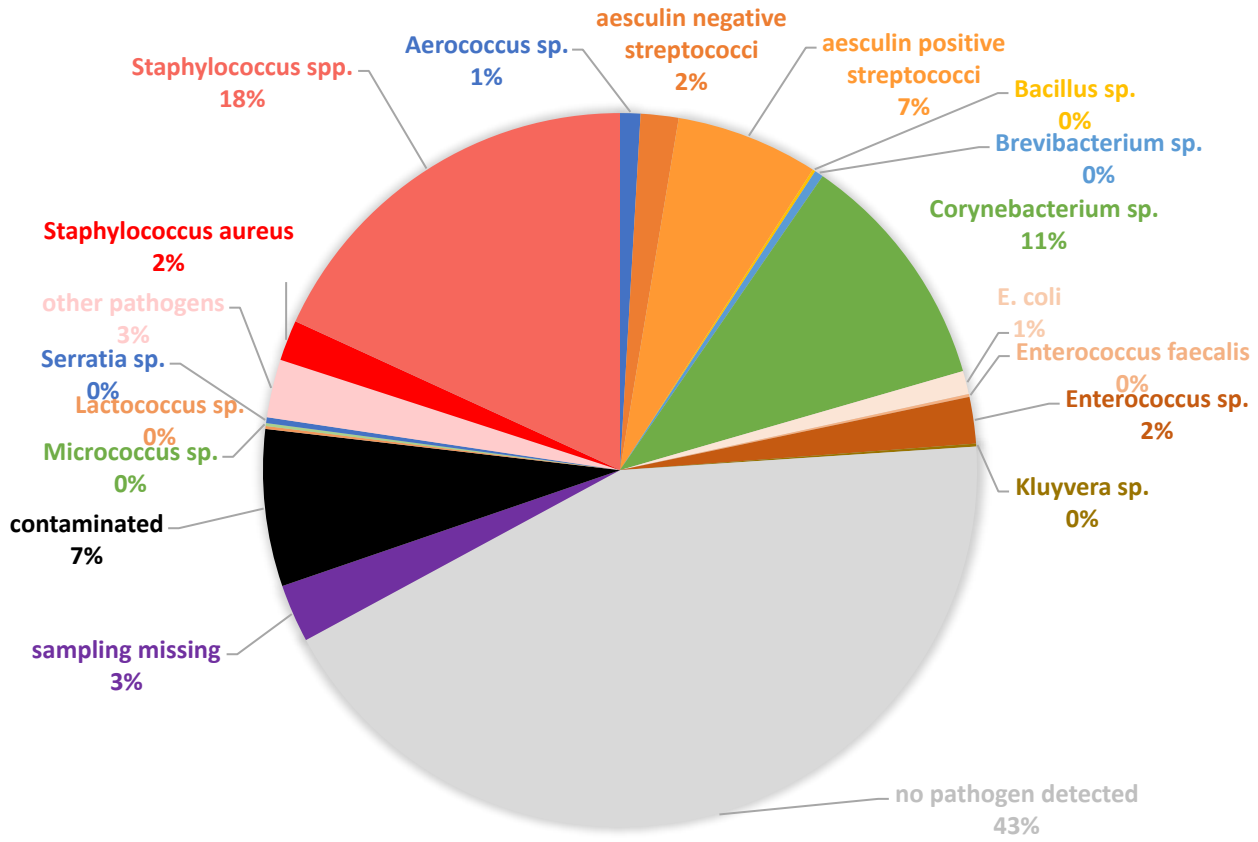
Table 1: MIR-Inhaltstoffe und -MastiMIR Parameter Berateransicht

Name	StallNr.	Lebensnr.	Rasse	L-Nr	L-Tage	Mkg	ZZ	L%	Na	K	Ka	KaBlut	Lactoferrin	BHB	BHBBlut	MMI	MM
JANA 3	6	276000817318152	HOL	2	42	39,5	38	5,13	299	1358	1182	2,44	50	0,29	2,90	92	MM4
PETINA 1	27	276000817039643	RED	1	400	15,7	260	4,52	405	1214	1554	2,55	129	0,46	1,98	95	MM4
WASA 4	55	276000816691556	SIM	3	37	32,0	115	4,88	338	1570	1255	2,39	66	0,33	4,76	99	MM4
FAGI 2	59	276000815779670	SIM	5	233	10,7	272	4,01	544	1490	1526	2,53	580	0,29	1,16	88	MM4
WENNY 10	73	276000817039692	SIM	2	18	20,4	9999	4,59	420	1394	1329	2,44	435	0,24	1,43	96	MM4
GILBA 1	74	276000817318201	SIM	1	29	27,1	138	4,62	432	1557	1073	2,39	276	0,29	2,80	92	MM4
WOLPOS 2	3	276000815779681	SIM	6	86	22,8	135	4,42	460	1474	1202	2,42	443	0,19	2,12	80	MM3
WELEDI 2	5	276000816220463	HOL	5	15	34,6	30	5,07	341	1351	1334	2,41	113	0,13	0,97	67	MM3
WESERWIN	14	276000815127403	SIM	8	56	19,0	1877	4,77	406	1433	1262	2,40	304	0,19	0,97	71	MM3
FLORY	23	276000815127420	HOL	8	69	32,7	3692	4,47	427	1479	1103	2,41	335	0,16	2,03	81	MM3
WERKANE 6	32	276000817318203	SIM	1	191	24,8	260	4,70	343	1525	1397	2,50	91	0,26	2,75	82	MM3
FLORY 3	37	276000817039647	HOL	2	36	38,7	29	4,98	337	1427	1195	2,41	50	0,19	1,84	81	MM3
WASABI	38	276000814622165	SIM	9	300	11,0	172	4,30	538	1314	1397	2,44	649	0,22	1,32	82	MM3
TANNIRO 2	46	276000815779656	SIM	5	279	17,4	1252	4,42	448	1238	1387	2,44	417	0,23	1,89	78	MM3
TANNIRO 5	47	276000817318216	SIM	1	18	31,9	82	4,97	375	1455	1101	2,39	105	0,16	1,35	71	MM3
OELE 7	56	276000817039718	HOL	2	57	32,4	23	5,36	246	1359	1273	2,40	50	0,12	1,11	68	MM3
UNO	57	276000946407359	SIM	8	251	16,6	2304	4,17	542	1588	1235	2,45	709	0,26	1,77	71	MM3
COSMAN	62	276000815459696	SIM	7	330	16,7	8096	3,22	840	1712	1144	2,47	1250	0,51	1,43	85	MM3
BEVERLY I	89	276000816313191	HOL	3	368	19,1	391	4,26	497	1371	1481	2,46	612	0,29	1,52	80	MM3
PIETE 1	96	276000815779703	HOL	5	289	18,1	1905	4,22	548	1440	1517	2,41	734	0,22	0,65	79	MM3
WOLKRO 3	102	276000816220460	SIM	5	81	31,3	86	4,91	336	1438	1241	2,46	109	0,19	2,39	71	MM3
COLAN 2	107	276000815459726	SIM	5	413	16,6	438	4,65	460	1175	1377	2,38	661	0,17	0,64	68	MM3
CONSTA 9	115	276000817608239	SIM	1	256	23,4	162	4,85	323	1429	1260	2,45	231	0,27	1,91	76	MM3

MastiMIR Results

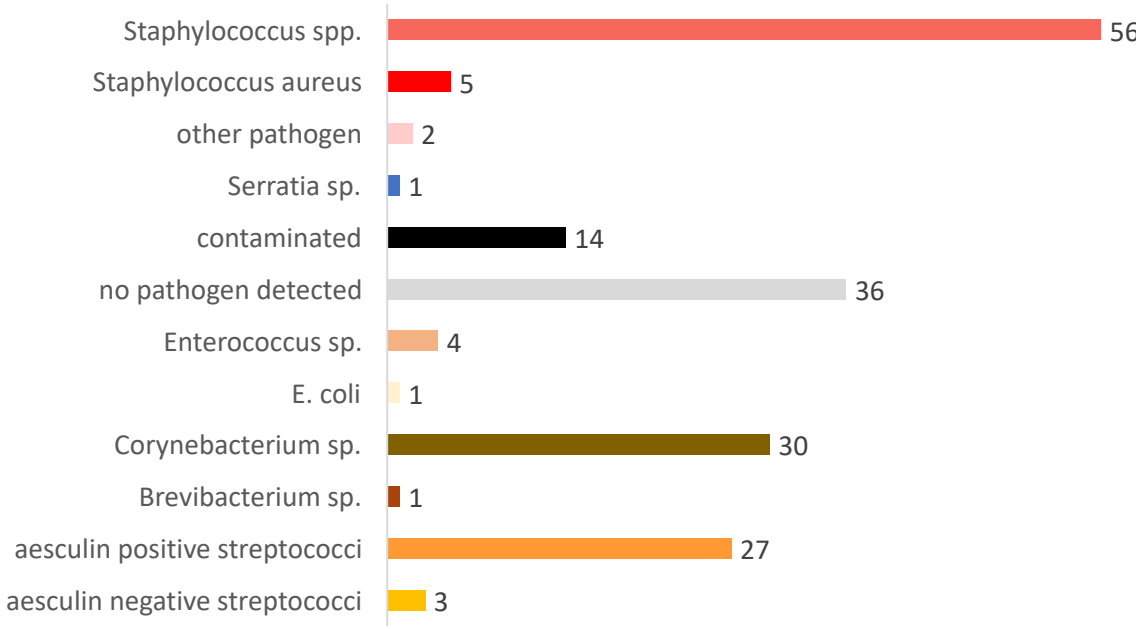


180 Animals with bacteriological analysis



MastiMIR Results

Results on the number of animals with mastitis
Bacteriological examinations



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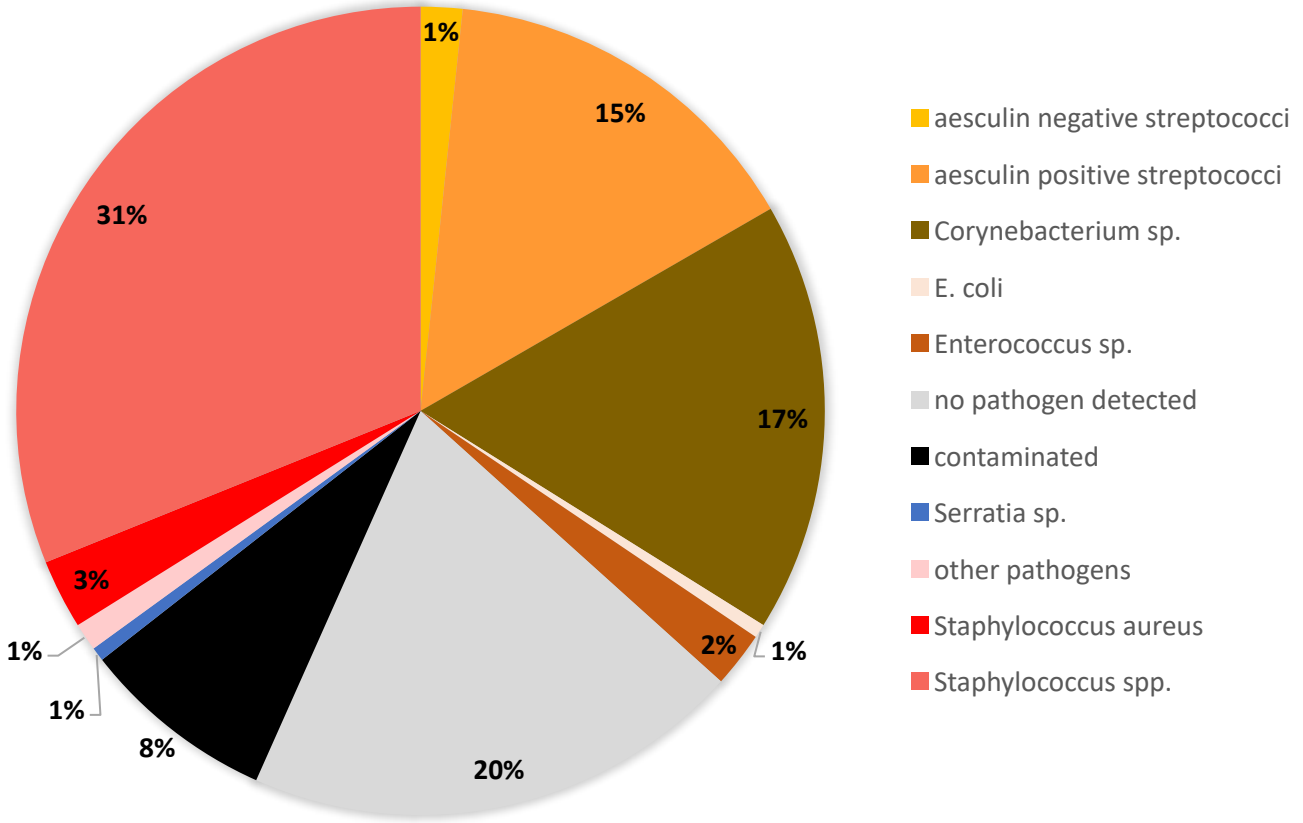

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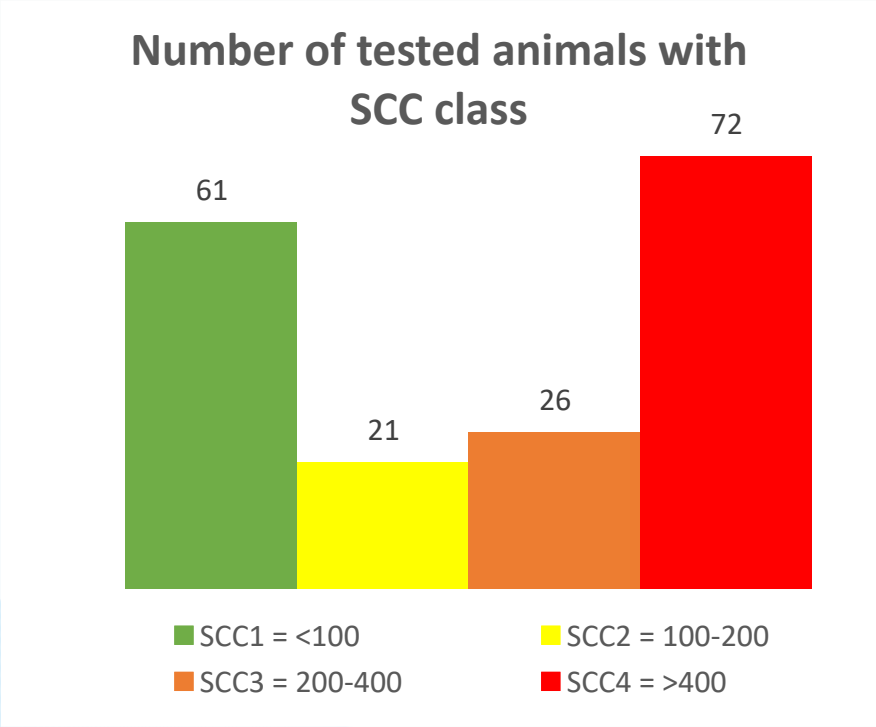
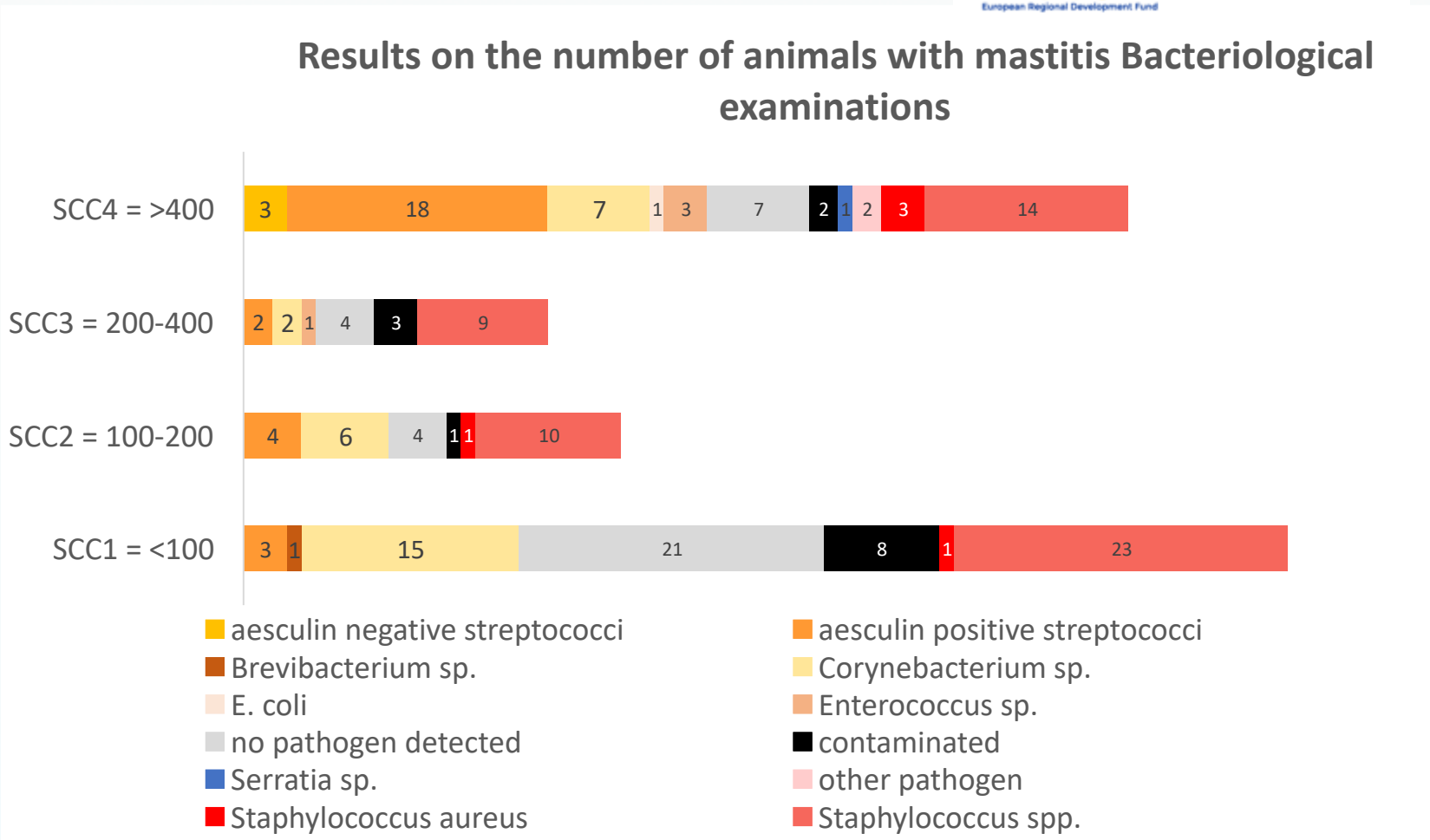
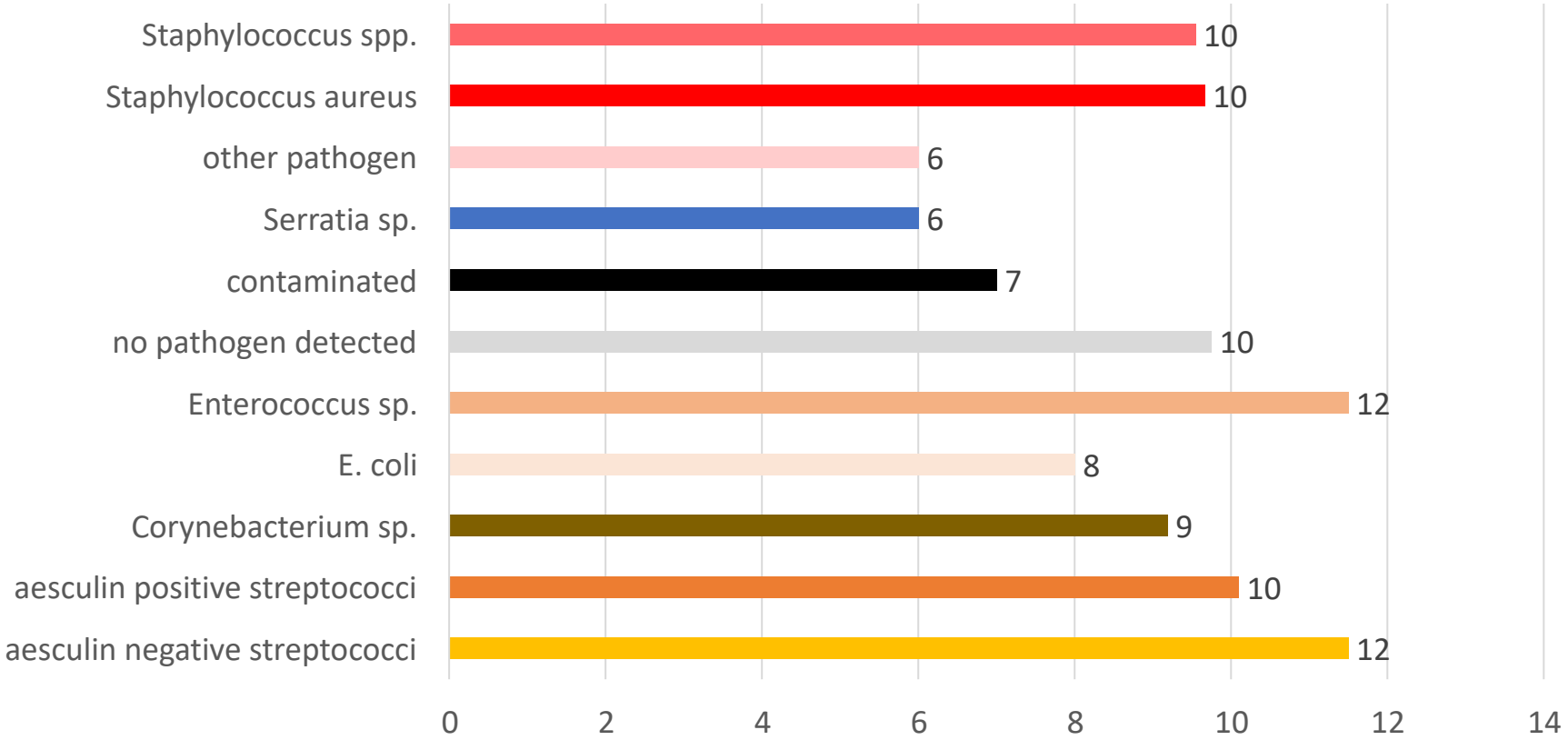
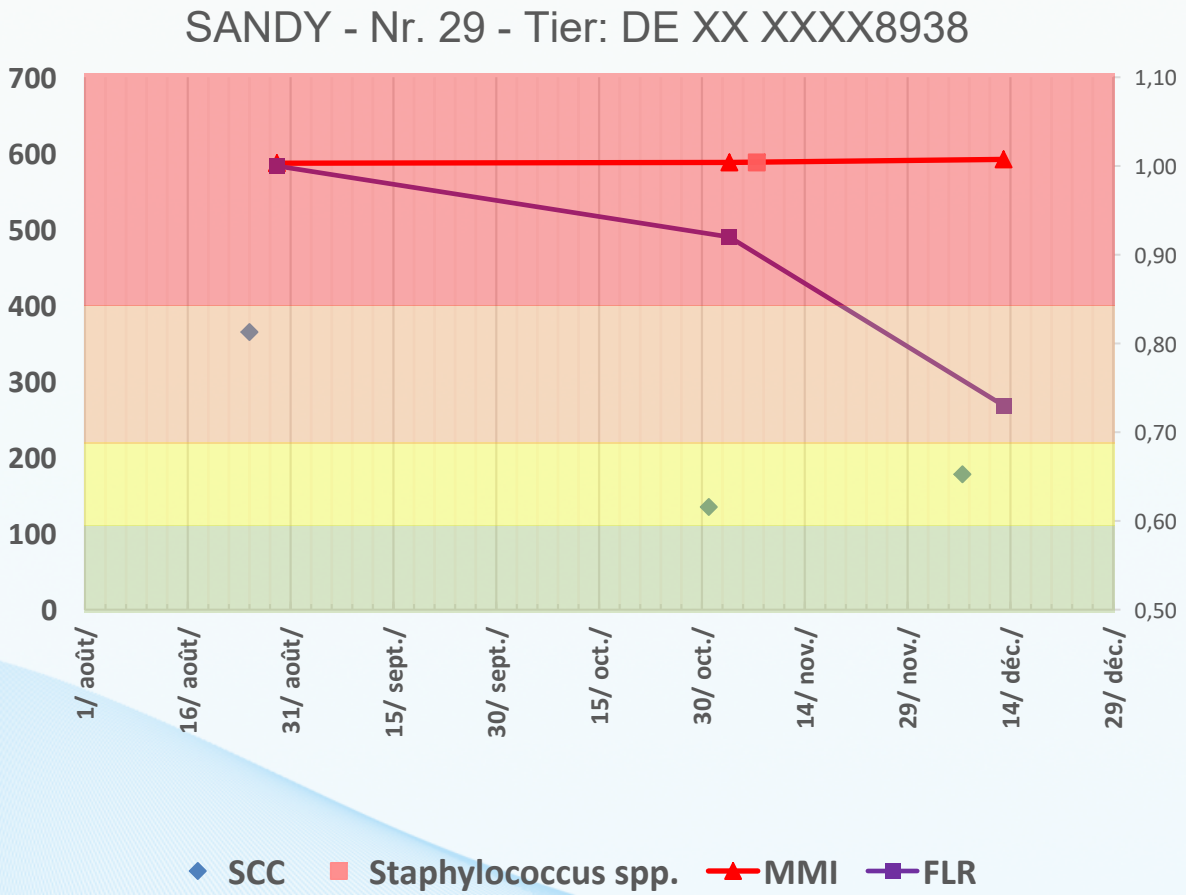


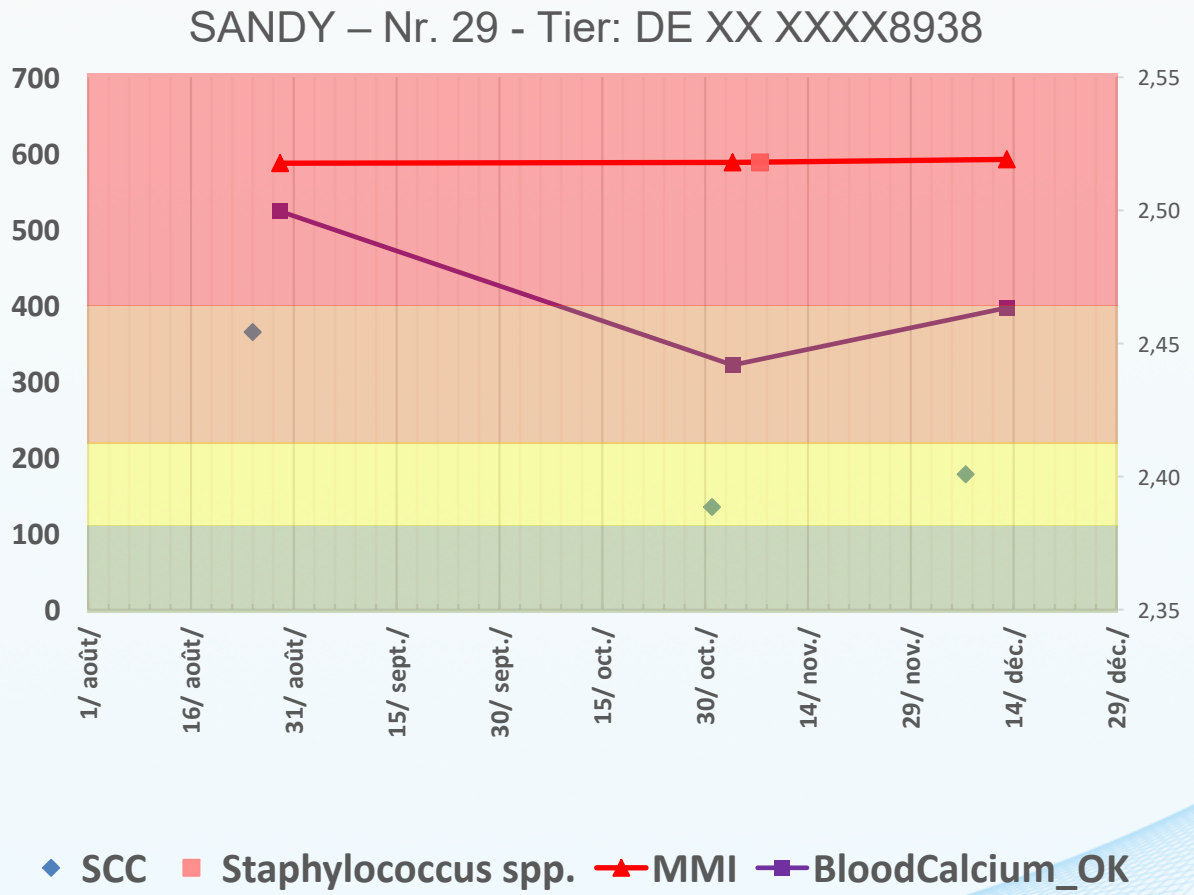


Mean days after milk recording analysis – bacteriological sample



MastiMIR Results





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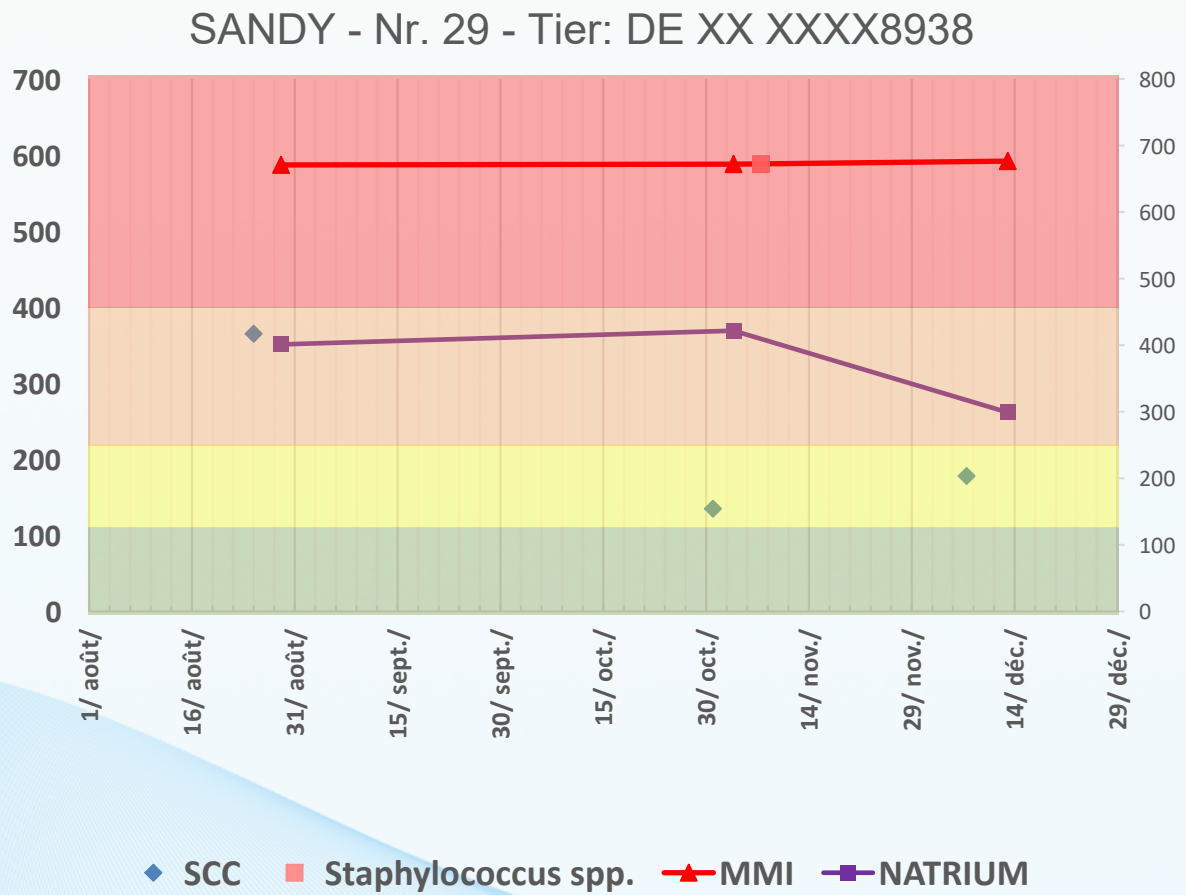
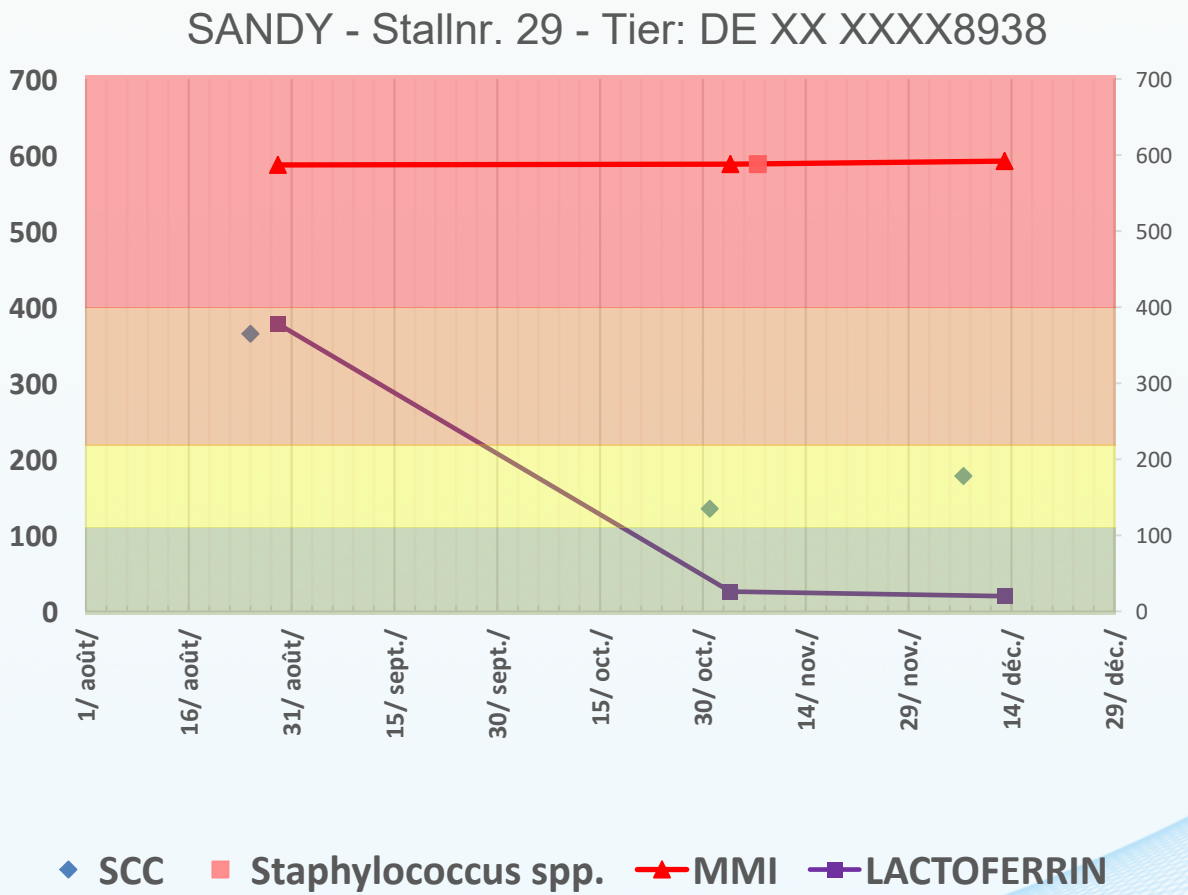
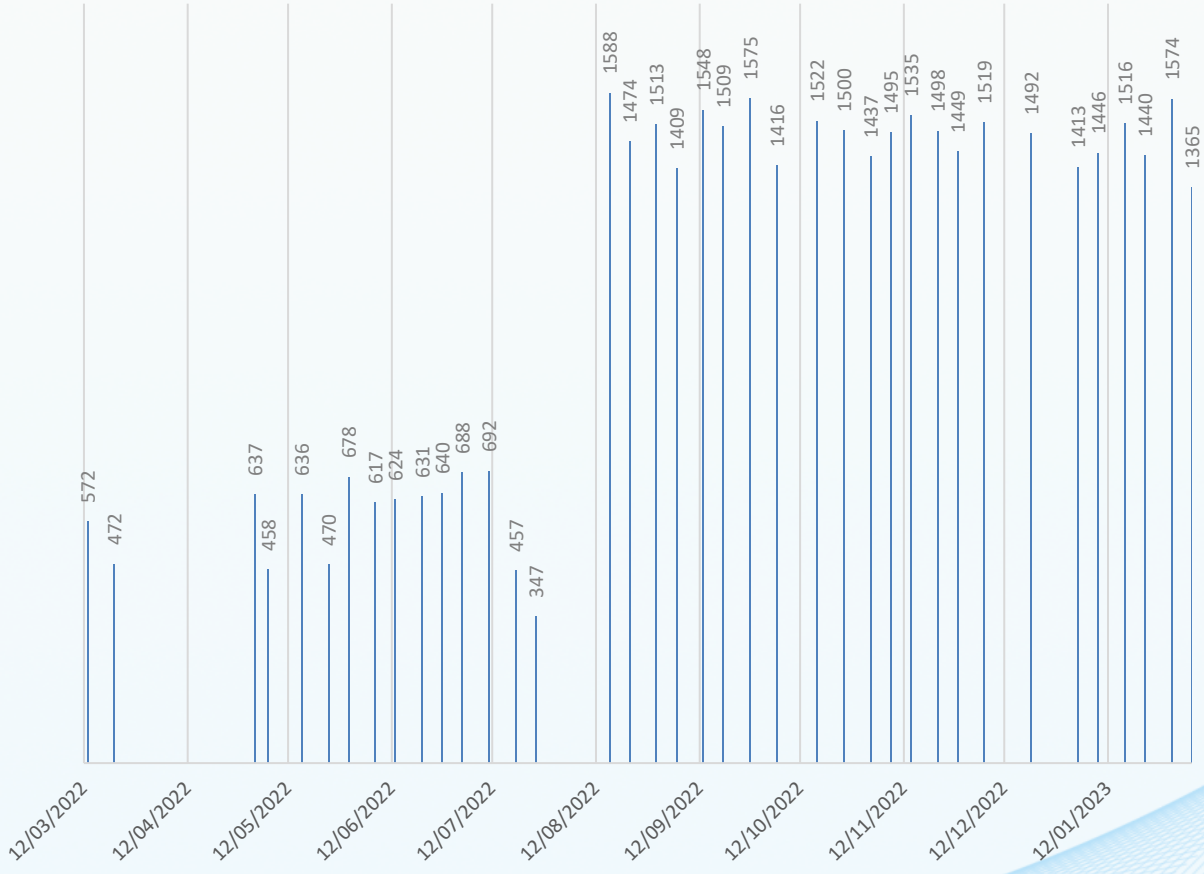
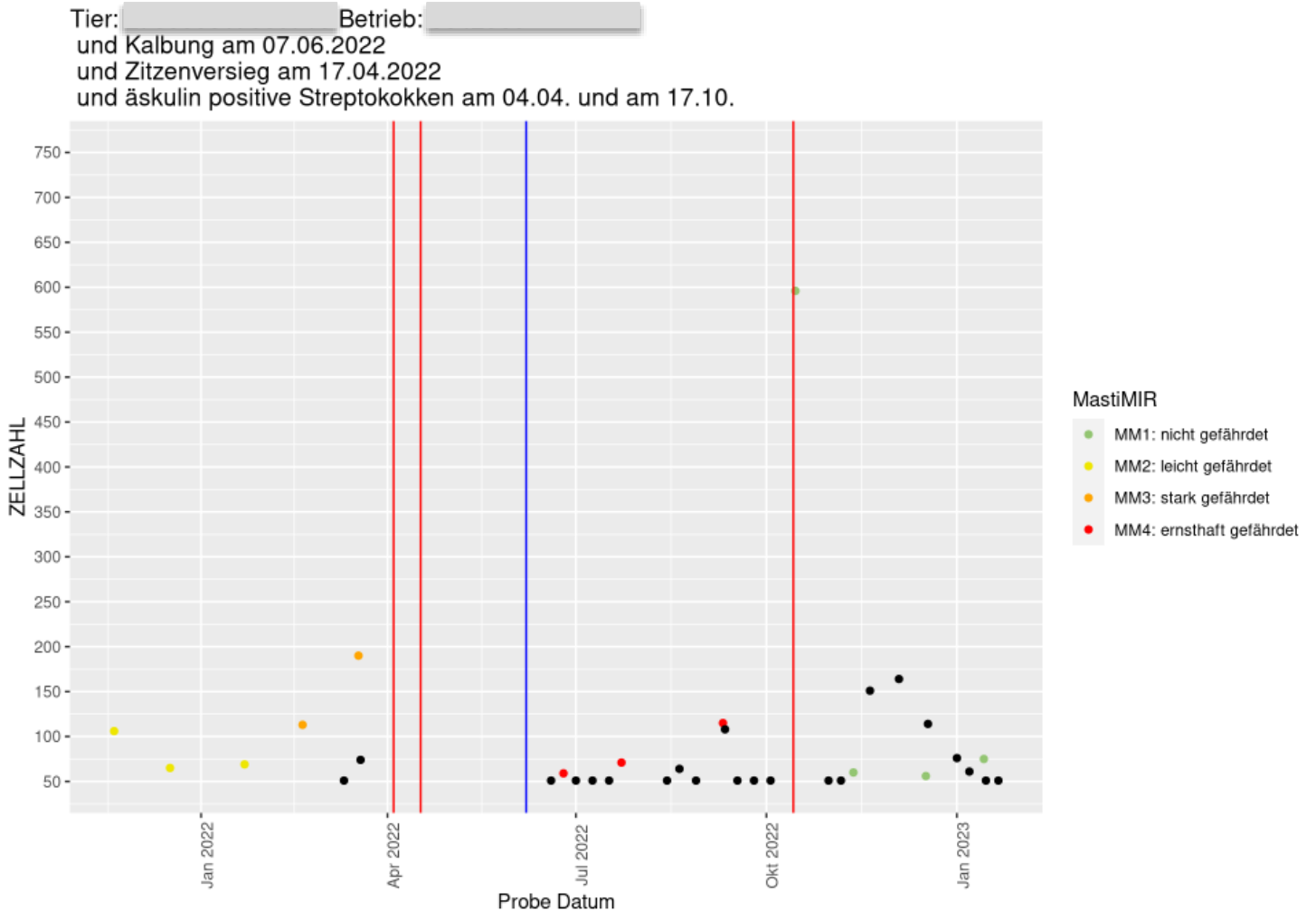




LKVBW – 36xxxxx– Genocell – MastiMIR



LKVBW – 36xxxxx – Genocell – MastiMIR



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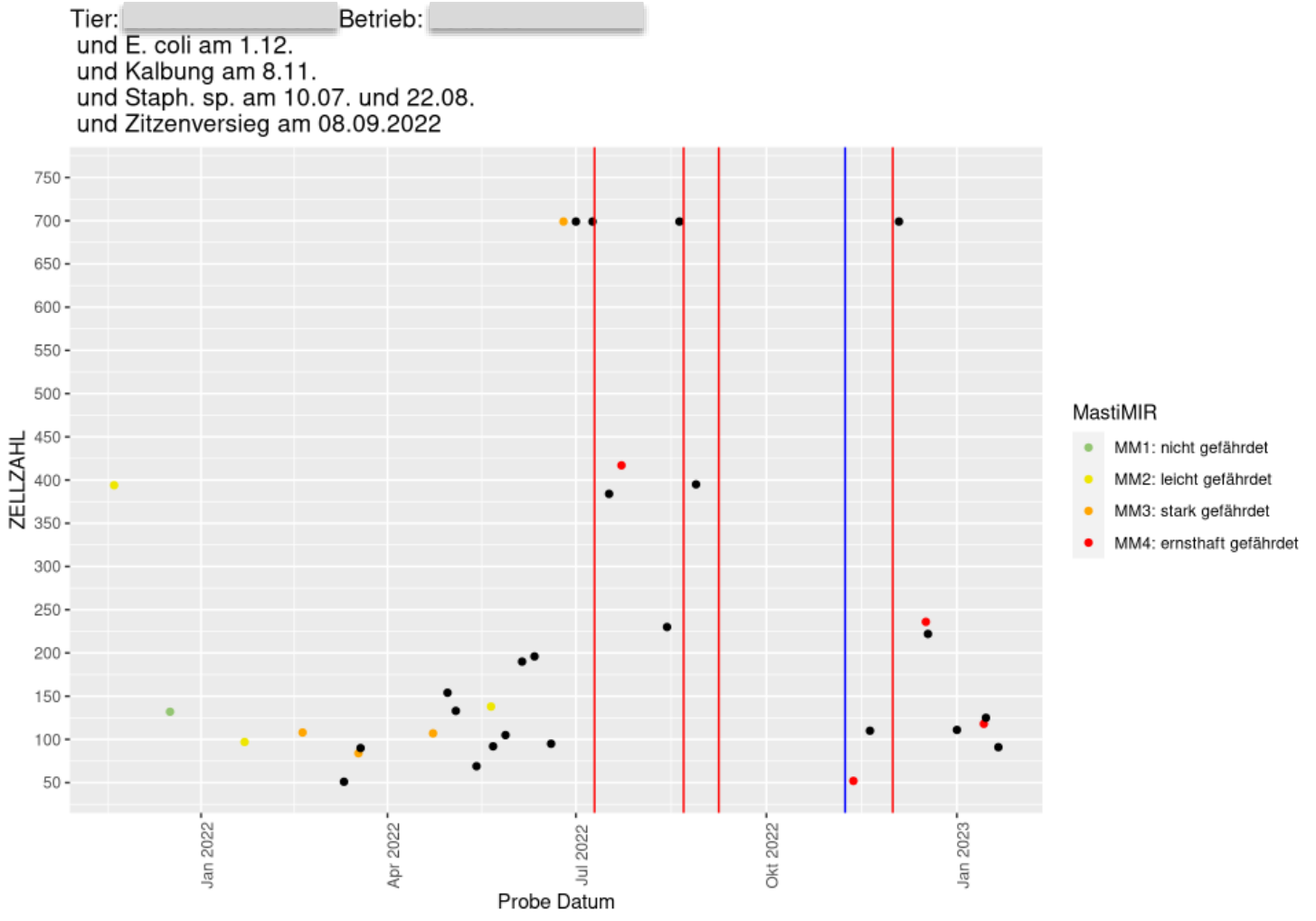
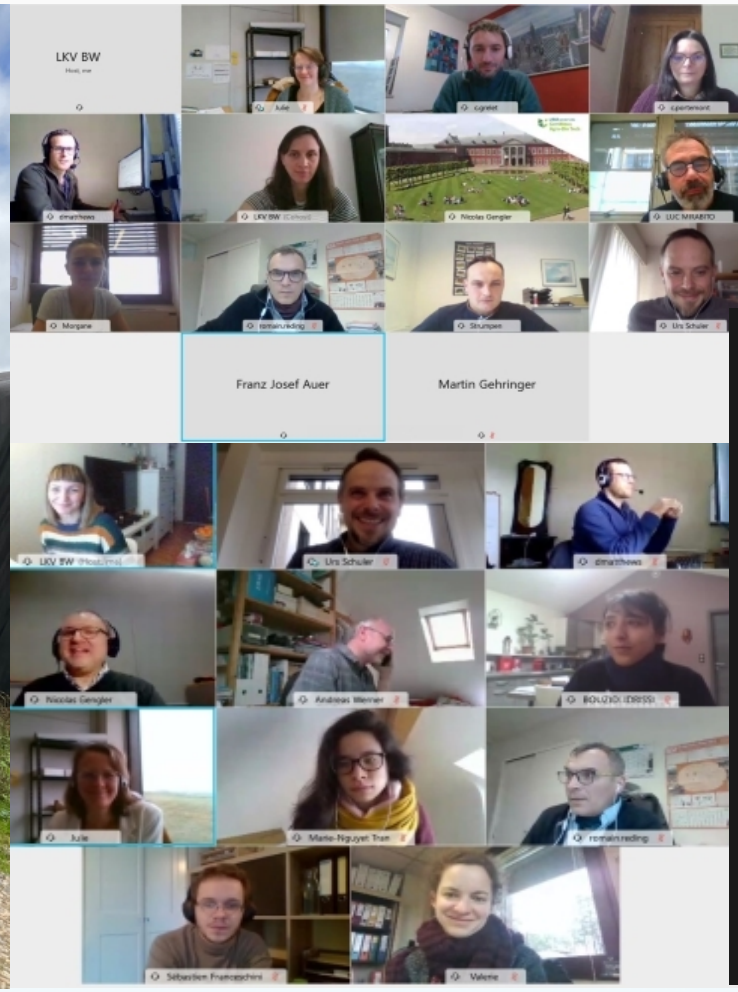
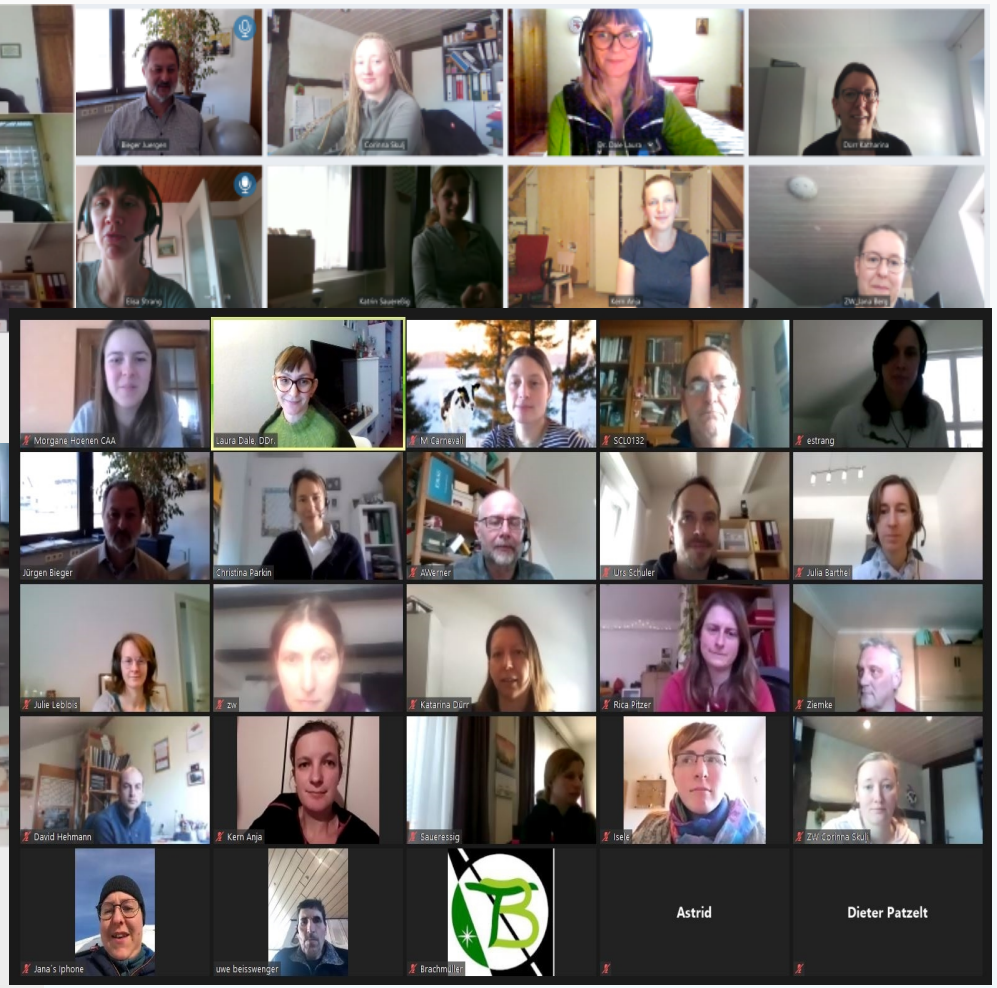


Conclusion

- ✓ Animals that appeared red on the report are often infected with a pathogen.
- ✓ MastiMIR seems well suited as an early warning system for the farmer or veterinarian
- ✓ Early treatment of udder problems

  → Cost saving
- ✓ Integration in the herd manager as a monitoring recommendation





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Thank you for your attention