K-Projekt **ADDA** – **AD**vancement of **D**airying in **A**ustria
„Strategies to a Reduced Antimicrobial Use in Cattle“

Bacteriological milk samples and udder health

ICAR, Udder health meeting, 13th of June, 2017, Edinburgh

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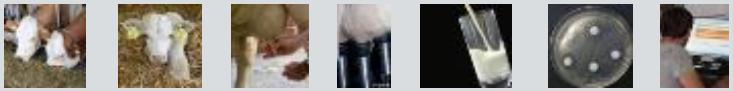
COMET Competence Centers for Excellent Technologies
FFG
bmvit Bundesministerium für Verkehr, Innovation und Technologie
bmwfj Bundesministerium für Wirtschaft, Familie und Jugend
wirtschaftsagentur wien Ein Fonds der Stadt Wien

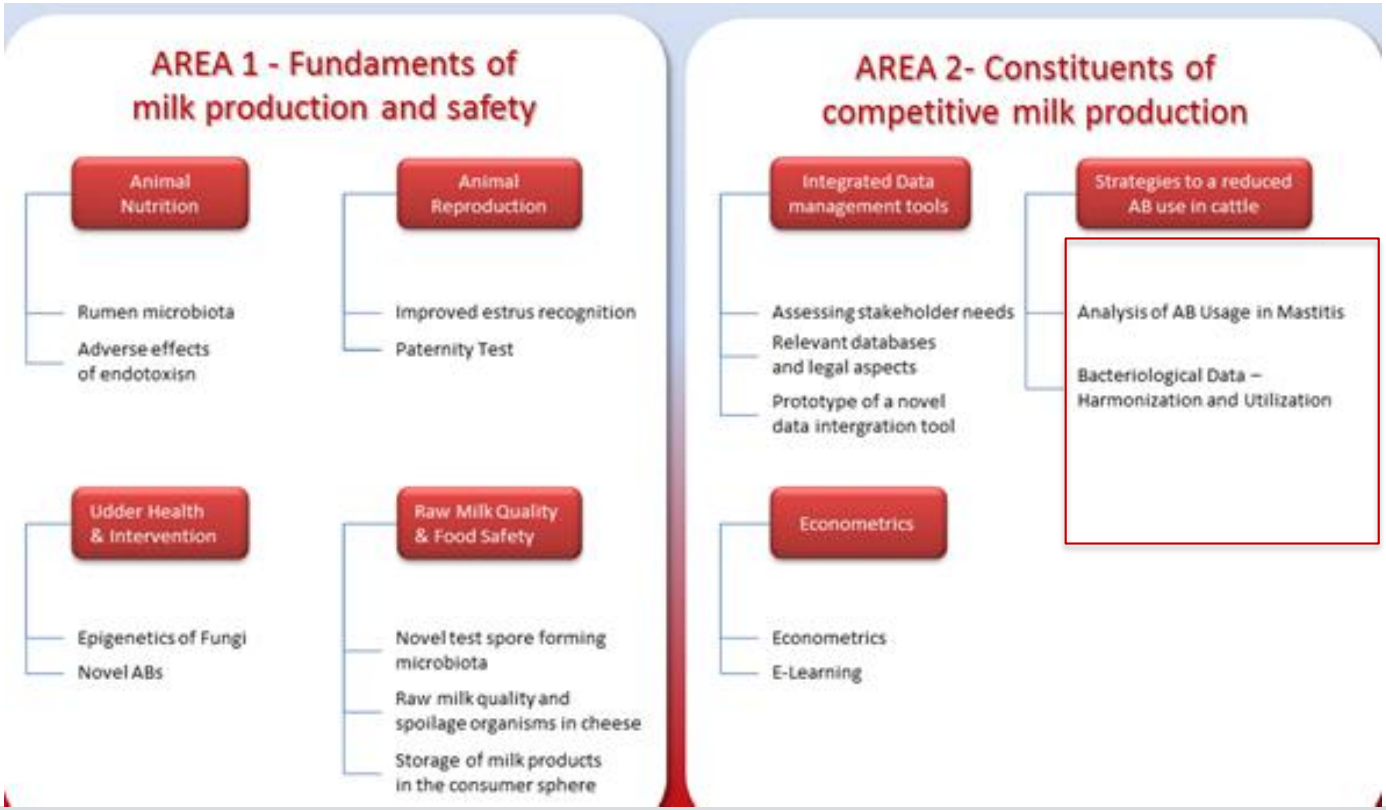
Background

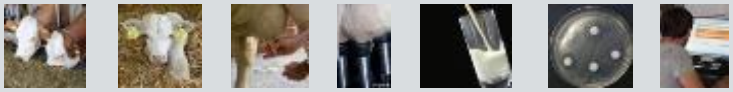
- Improvement of udder health is important
  - herdmanagement
  - genetic improvement
  - food safety
- Various data sources of importance
  - somatic cell count, diagnoses, pathogen information,..
- Bacteriological milk samples (pathogens)
  - Targeted treatment
  - relevant in the context of reduction of use of antimicrobials
  - additional information for genetic and herd management



ADDA „Advancement of Dairying in Austria“ Project 2014-2017

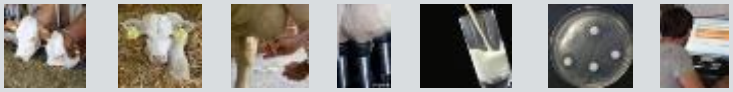
- Research along the dairy chain including partners from farmer organisations, animal health service, feed companies, milk processors, labs, chamber of veterinarians, universities etc.





Strategies to a reduced use of antimicrobials in cattle

- *Subproject 1 (A2_P1):* **Added value of linkage of various data sources on udder health**
  - somatic cell count, diagnoses, bact. milk samples, bulk milk results
- *Subproject 1 (A2_P2-SP1):* **Harmonization in bacteriological data generation**
  - harmonisation of methods for bacteriological analyses of milk samples
  - harmonisation of definition of results – link to health key
  - electronic data transmission to central cattle data base– interface



What is important for stakeholders?

(Result of ADDA-survey on farmers and vets)

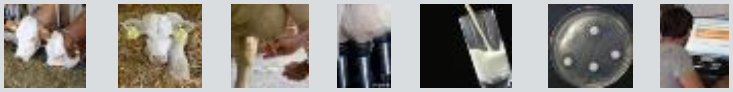
% very important and important

	Farmer	Veterinarian
Bacteriological milk samples	81	94
Milk samples for dairies	78	74
Diagnoses/electr. drug controll receipt	73/72	72
Disease status	72	83
Lab results	63	88-89
Services of milk recording		79
Results from feed analyses		78

Publications:

Perner, J., Egger-Danner, C., Weissensteiner, R., Fürst-Waltl, B., Wittek, T. (2016). Untersuchungen zur Entwicklung tierärztlicher Tätigkeiten in der Milchviehwirtschaft in Österreich unter besonderer Berücksichtigung der Datenverarbeitung in Tierarztpraxen. Wiener Tierärztliche Monatsschrift , 6/2016.

Weissensteiner, R., Fürst-Waltl, B., Gstöttinger, F., Hörmann, M., Janacek, R., Koblmüller, M., Mayerhofer, M., Perner, J., Schagerl, M., Schoder, G., Wittek, T., Zottl, K., Obritzhauser, W., Egger-Danner, C. (2016). Erhebung zur Nutzung von Daten in der Milchviehzucht – aktueller Stand und Weiterentwicklungsbedarf. Züchtungskunde (submitted)



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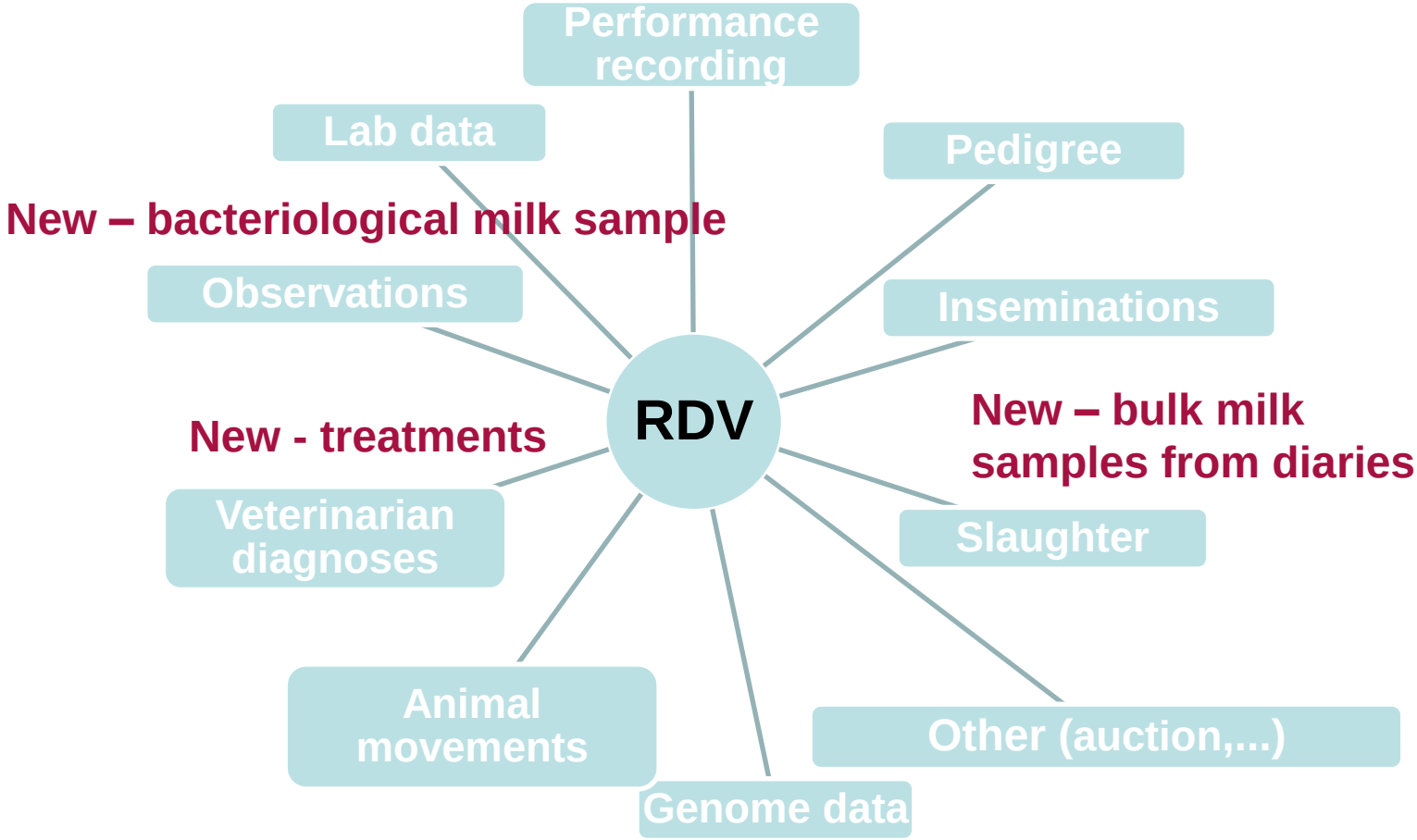
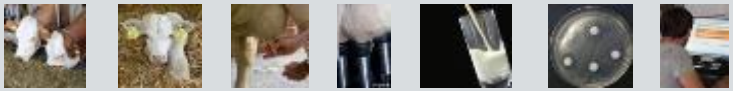
Central cattle database (RDV)

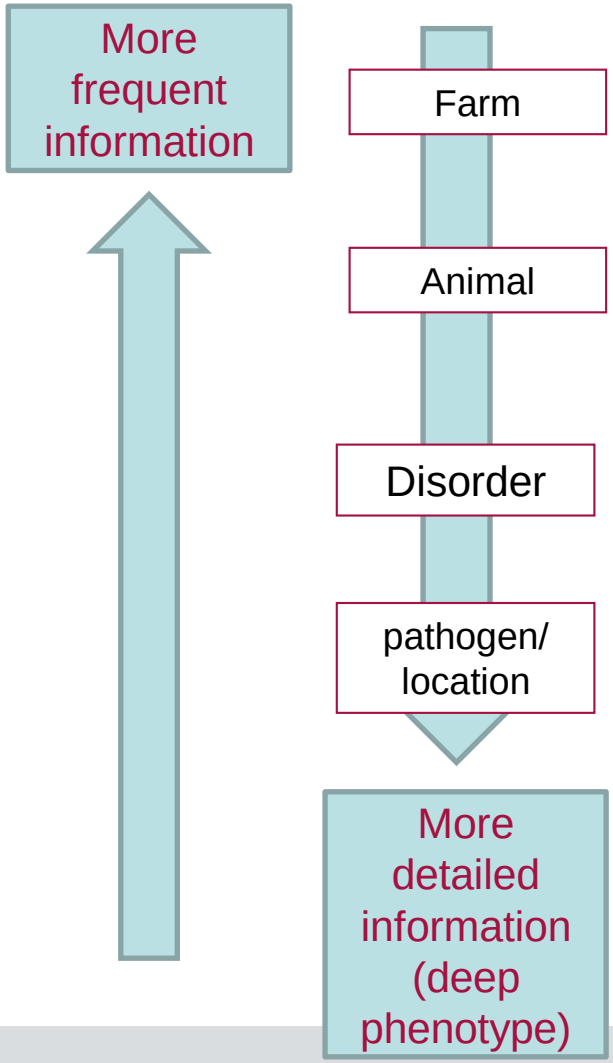


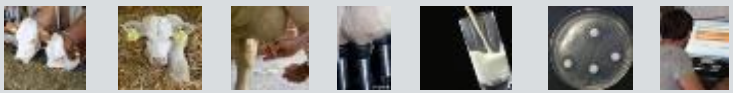
AIM: generation of added value by merging data and turning this data into information



From frequent overview to detailed information e.g. udder health

- Dairy: bulk tank milk sample
  - *at least weekly*
  - *herd based*
- Data from milk recording
  - every 4-6 weeks
  - animal based
- Farmer observations – real time
- Veterinarian diagnoses / treatment
  - real time information
- Results from laboratories
  - e.g. bacteriological samples (each quarter)
- Other information (AMS, MIR,..)





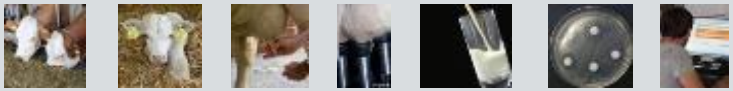
Pilot project

Observational study from 01-10-2015 till 30-09-2016

- Use of antimicrobials in dairy farms focus on mastitis
  - 250 farms with about 7000 cows
  - 17 veterinarians

- Treatment data from vets
  - Electronic interface directly to central database

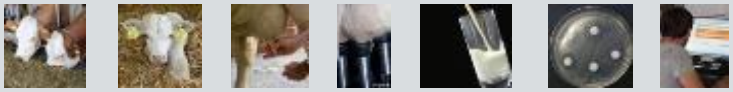
- Sampling of each quarter before treatment
  - Bact. – interface („milk-bacteriological analyses“)



Added value of data integration
Bacteriological data

Preconditions – work to do:

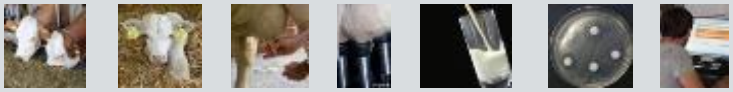
- Standardisation for data integration -
  - *Starting point AUSTRIA*: 6 laboratories with differences regarding bacteriological analyses (methods), coding, ... - no comparable results
  - *Starting point AUSTRIA :* results primarily provided in a format that cannot be integrated in the central cattle database



Bacteriological milk samples

Harmonised analyses of bacteriological milk samples

- Aim: Integration of results of bacteriological milk samples into central database
  - ✓ Standardised methods (guideline)
  - ✓ Defined Code-Set (ADIS-ADET)
  - ✓ Definition der BACT-interface
  - ✓ Access of labs to central database
  - ✓ Clarification of data protection issues
  - ≠ Check of resistance: unified panel to test antimicrobials (different labs use different panels – needs further work!)



Bacteriological milk samples

Harmonisation of methods

- ✓ Standardised methods (Guideline)

LEITLINIE FÜR EINE HARMONISIERTE METHODIK
BAKTERIOLOGISCHE MILCHUNTERSUCHUNG

gültig in	<Labor>
gültig für	<Personen, für die das Dokument gültig sein soll, z.B. "alle MA">
Zweck	Diese Leitlinie beschreibt den bakteriologischen Nachweis von euterpathogenen Keimen.
untersuchte/r Parameter	Die hier dargestellte Methodik der bakteriologischen Viertelgemelksuntersuchung umfasst die Differenzierung von Mastitis-Erregern
Matrix	Milch
Übersicht	1 Begründung ..... 1 2 Verfahren ..... 2 3 Verwendete Begriffe, Abkürzungen und Symbole ..... 2 4 Warn- und Sicherheitshinweise ..... 2 5 Geräte und Hilfsmittel ..... 2 6 Reagenzien, Lösungen und Testorganismen ..... 2 7 Probenahme, Probenvorbereitung und -behandlung ..... 4 8 Durchführung 5

Bacteriological milk samples

Harmonisation

✓ Defined Code-Set (ADIS-ADET*)

	Bezeichnung	Meldung an RDV
Streptokokken	Sc. agalactiae	8.1.2.1.
	Sc. Gr. C	8.1.2.107.
	Sc. dysgalactiae	8.1.2.2.
	Sc. equi	8.1.2.107.
	Sc. uberis	8.1.2.3.
	Streptococcus sp.	8.1.2.4.
	Sc. equinus	8.1.2.4.
	Sc. canis	8.1.2.28.
	Sc. saccharolyticus	8.1.2.108.
	Sc. Gr. D	8.1.2.108.
	Sc. faecium	8.1.2.55.
	Sc. faecalis	8.1.2.56.
	Sc. alactolyticus	8.1.2.108.

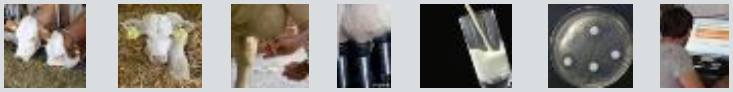
	Bezeichnung	Meldung an RDV
Staphylokokken	Staph. aureus	8.1.2.5.
	Staph. hyicus	8.1.2.94.
	Staph. intermedius	8.1.2.95.
	KNS (Koag.-neg. Staph.)	8.1.2.6.
	sonstige Mikrokokken	8.1.2.7.

	Bezeichnung	Meldung an RDV
Gram-Negative	E. coli	8.1.2.8.
	Klebsiellen	8.1.2.9.
	Klebsiella pneumoniae	8.1.2.58.
	andere Enterobakterien	8.1.2.10.
	Pseudomonaden	8.1.2.14.
	Pasteurellen	8.1.2.15.

	Bezeichnung	Meldung an RDV
Sonstige	A. pyogenes	8.1.2.11
	andere Corynebakterien	8.1.2.12.
	Bacillus spp.	8.1.2.13.
	Mycoplasma sp.	8.1.2.16.
	Hefen	8.1.2.17.
	Prototheken	8.1.2.18.
	Sonstige Erreger	8.1.2.19.

*ADIS: according ISO 11787 international standardised data transmission matrix for electronic exchange of agricultural data

ADED = standardised Data Dictio-nary for agriculture



Bacteriological milk samples

Harmonisation

✓ Interface for electronic data transfer

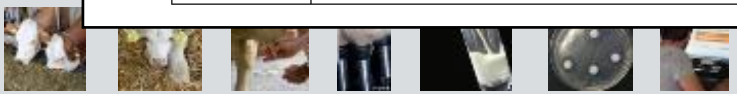
SCHNITTSTELLE BAKTERIOLOGISCHE EUTERBEFUNDE

ZuchtData EDV-DIENSTLEISTUNGEN GMBH

Die Schnittstelle dient zur Meldung von bakteriologischen Euterbefunden in den Rinderdatenverbund.

Satzaufbau:

Lfd.Nr	Feld	Pflichteintrag	Format	Beispiele
1	Labor-ID	Ja	text	Lab01
2	LFBIS Betrieb	Ja	Zahl(8)	1234567
3	Tier Lebensnummer	Ja	text	040000123456789 AT 123456789 AT 123.456.789
4	Probedatum	Ja	DD.MM.YYYY	01.01.2014
5	Befundcode	Ja	Text	8.1.2.
6	Lokationscode	Nein	Text	HL, V, VR
7	Laborinterne Protokollnummer	Nein	Text	BU123456



Bacteriological milk samples

standardized and labs can access database

Comet K-Projekt ADDA

Advancement of Dairying in Austria

- **Laboratories**

Verwendete Codesets:

Befundcodes

8.	Laborbefunde
8.1.	Milchdiagnostik
8.1.2.	Milch-Bakteriologie (BU)
8.1.2.1.	Sc. agalactiae (Gelber Galt)
8.1.2.10.	Enterobacteriaceae spp.
8.1.2.100.	Staph. saprophyticus

SCHNITTSTELLE BAKTERIOLOGISCHE EUTERBEFUNDE

Die Schnittstelle dient zur Meldung vonlbakteriologischen Euterbefundenin den Rinderdatenverbund.

Satzaufbau:

lfd.Nr	Feld	Pflichteintrag	Format	Beispiele
1	lLabor-ID	Ja	text	lLab01
2	lLFBIS Betrieb	Ja	Zahl(8)	1234567
3	lTier Lebensnummer	Ja	text	l040000123456789 lAT 123456789 lAT 123.456.789
4	lProbedatum	Ja	DD.MM.YYYY	l01.01.2014
5	lBefundcode	Ja	Text	l8.1.2.
6	lLokationscode	lNein	Text	lHL, V, VR
7	lLaborinterne Protokollnummer	lNein	Text	lBU123456

Beschreibung der Feldinhalte

1. lLabor-ID: noch festzulegender eindeutiger Code des Labors
2. lLFBIS Betrieb
3. lTier Lebensnummer: Im Format AT1234567 oder auch mit Interpunktion oder
   lIso_lebensnummer im Format 040000123456789
4. lProbedatum: Datum der Probenahme auf dem Betrieb
5. lBefundcode entsprechend nachstehender Liste
6. lLokationscode entwprechend nachstehender Liste
   lFür jedes Euterviertel wird eine eigen Datenzeile geliefert
7. lLaborinterne Protokollnummer, zur Erkennung von Änderungslieferungen

(non Staph. aureus)

hen, ausgeronnen)

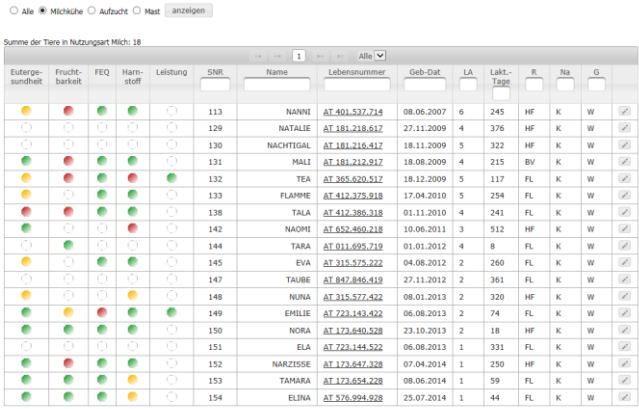
ittels PCR)

PCR)

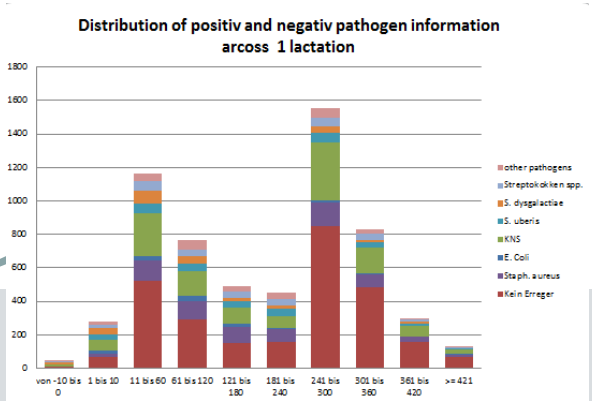
8.1.2.125.	Chlamydia spp. (Nachweis mittels PCR)
8.1.2.13.	Bacillus spp.
8.1.2.14.	Pseudomonas spp.
8.1.2.15.	Pasteurella spp.
8.1.2.16.	Mycoplasma spp.
8.1.2.17.	Hefen
8.1.2.18.	Prototheca spp.

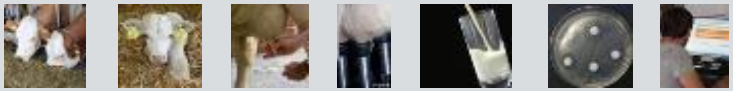
- **Cattle database**

Access of laboratories to evaluations of data base implemented



New information for farmers





Bacteriological milk analyses

Comet K-Projekt ADDA

Advancement of Dairying in Austria

- ✓ Access of labs to various features of herdmanager (software) from central cattle database to support

Betrieb | Tier | Grafik | Gesundheit | Admin — Hilfe | Abmelden

Tierliste — Betriebsnummer 2500 — Name Max Mustermann

Alle | Milchkühe | Fleisch | Mastkühe | Mutterkühe | Aufzucht | Mast | Vatertiere

Stichtag/Datum von: 04.02.2016 — Datum bis: — anzeigen

Summe der Tiere in Nutzungsart Milch: 88

SNR	Name	Lebensnummer	Geb-Dat	R	Na	G	Vat
2	OLLI	AT 484.014.418	27.11.2010	HF	K	W	
3	GERLINDE	AT 753.057.718	16.04.2011	HF	K	W	
5	SUSE	AT 100.211.422	29.11.2012	HF	K	W	
6	MORENA			HF	K	W	MH
7	KATRIN			HF	K	W	
8	OHARA			HF	K	W	
9	BUNA			HF	K	W	
10	LORI			HF	K	W	
11	AMY			HF	K	W	
12	ANNA			HF	K	W	
13	GABI			HF	K	W	MH
15	OPTIMUS			HF	K	W	
16	BETINA			HF	K	W	
17	WALTRAUD			HF	K	W	

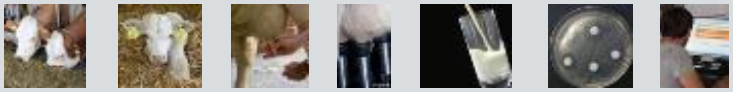
Betrieb | Tier | Grafik | Gesundheit | Admin — Hilfe

Übersicht — Betriebsnummer 2500 — Name Max Mustermann

Zellzahlen | Harnstoff | FEQ | Milch KG | Eiweiß

Grenze 1: 100 — Grenze 2: 300 — Aktualisieren

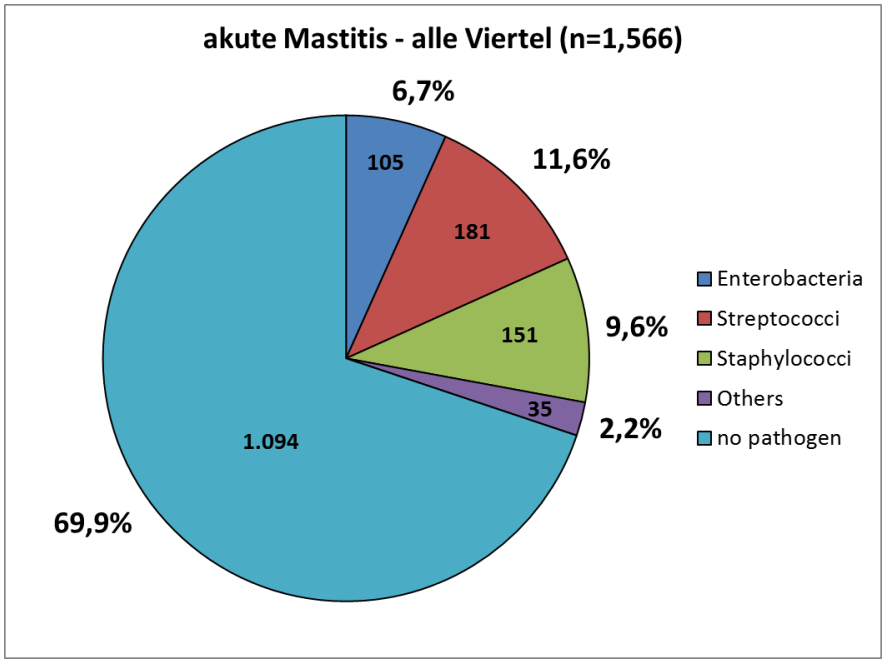
SNR	Name	Lebensnummer	Laktage	Laktzahl	MKg	23.09.15 (A)	15.08.15 (M)	03.07.15 (A)	28.05.15 (M)	20.04.15 (A)	06.03.15 (M)	27.01.15 (A)
2	OLLI		264	3	28,2	88	56	39	57	63	20	27
3	GERLINDE		311	1	T	T	264	653	235	307	114	73
5	SUSE		192	1	32,2	196	167	146	162	69		
6	MORENA		311	2	14,2	874	965	399	855	571	136	104
7	KATRIN		185	1	25,4	287	249	757	168	185		
8	OHARA		312	1	T	T	226	131	177	153	83	79
9	BUNA		7	4	36,8	35	T	83	76	92	77	46
10	LORI		192	1	25,6	142	163	56	118	58		
11	AMY		263	3	26,8	267	132	167	111	150	87	99
12	ANNA		237	2	26,2	237	73	162	66	51	21	T
13	GABI		30	2	49,0	533	T	T	303	303	120	139
15	OPTIMUS		135	1	29,2	103	33	34	87			



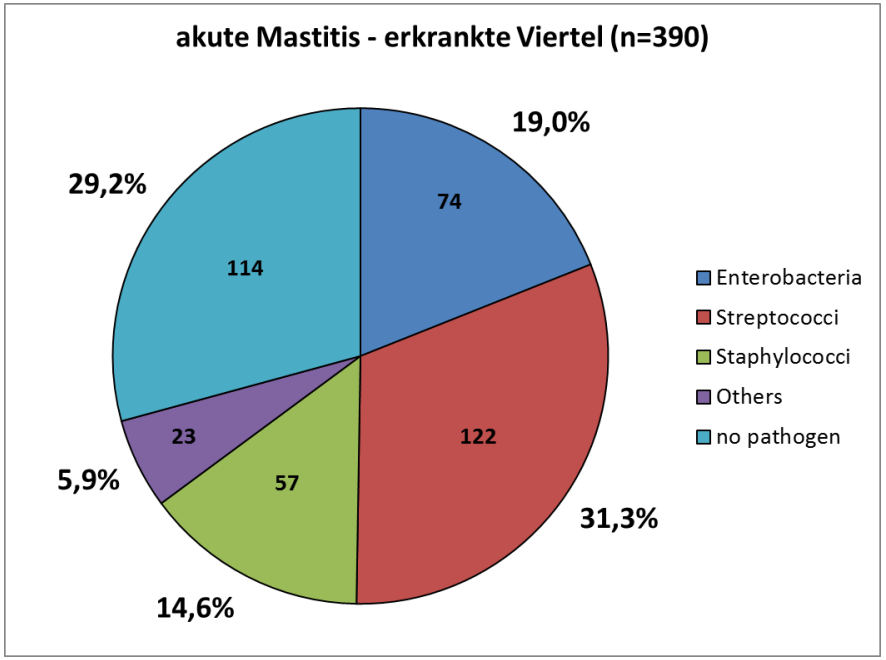
Pilot project ADDA – acute mastitis
Results on bact. milk samples

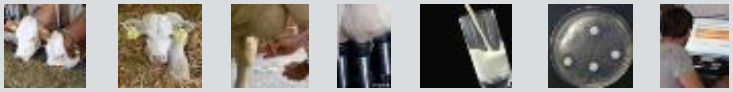
Results of bacteriological milk samples for veterinary diagnoses of acute mastitis

all quarters



diseased quarters





Bacteriological milk analyses

Examples of use for herd management

23 SINDI [redacted] **geb.: 02.04.2009**

Neue Aktion/Beobachtung erfassen...

1 2 3 4 5 15

Datum	LTag	Text
15.04.2017	67	. . . . . PM 26,0 3,73 2,95 28 12,0
07.03.2017	28	. . . . . PM 25,0 4,47 3,18 427 12,0
07.02.2017	0	6. Kalbung 2 N
27.01.2017	461	. . . . . PM trocken
17.12.2016	420	. . . . . PM trocken
30.11.2016	403	BMU S. aureus (HR) S. aureus (HL) K.E. (VR) K.E. (VL)
11.11.2016	384	. . . . . PM 10,8 3,91 4,32 483 12,0
03.11.2016	376	SCHALMTEST stark positiv vermutlich chronische Mastitis
04.09.2016	316	. . . . . PM 14,4 4,57 3,89 813 12,0
19.07.2016	269	. . . . . PM 22,0 4,26 3,39 317 9,0
08.06.2016	228	. . . . . PM 23,0 4,87 3,74 659 11,0
29.04.2016	188	. . . . . PM 30,0 5,50 3,37 59 10,0

Auswahl anzeigen:

- ☑ PM-Ergebnisse
- ☑ Untersuchungen
- ☑ Belegungen
- ☑ Beobachtungen
- ☑ Diagnosen
- ☑ BMU-Ergebnisse

Anwenden

Filter zurücksetzen

Results of the bacteriological analyses

→ **Further possibilities**

Datum	LTag	Text
30.11.2016	403	BMU S. aureus (HR) S. aureus (HL) K.E. (VR) K.E. (VL)
30.11.2016	403	BMU S. aureus (HR, HL) K.E. (VL, VR)
30.11.2016	403	. . . . . BMU S. aureus (HR, HL)
30.11.2016	403	. . . . . BMU keine Erreger

Bacteriological milk analyses
Examples of use for herd management

Comet K-Projekt ADDA

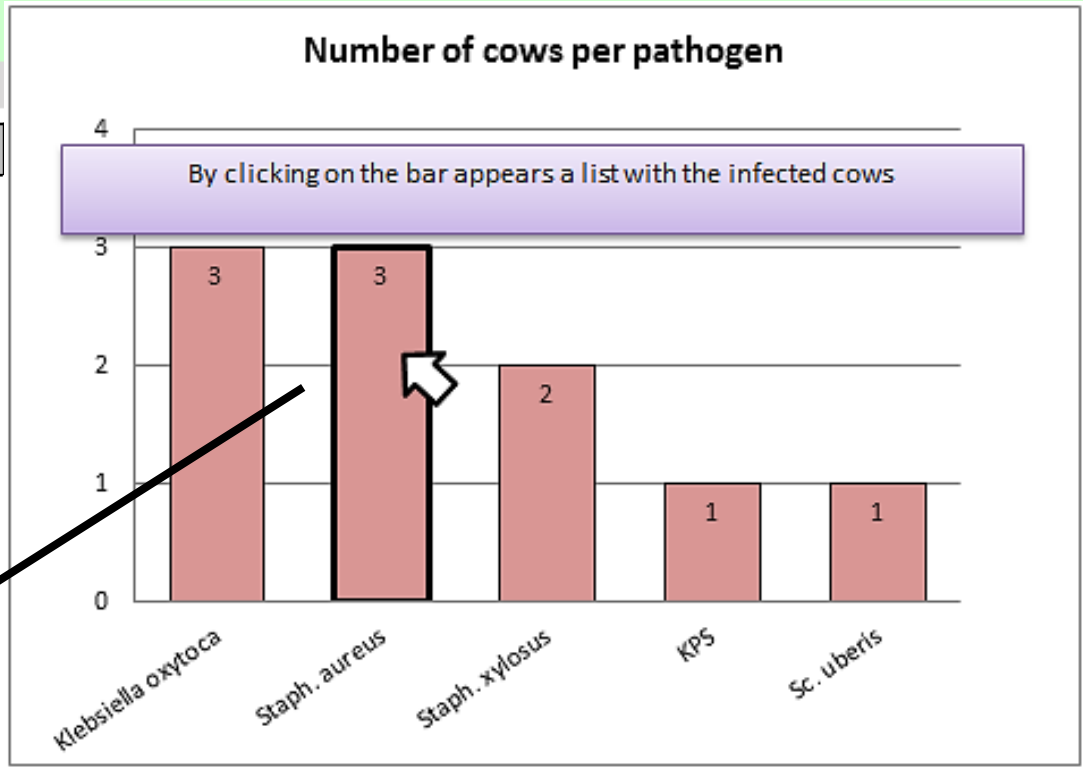
Advancement of Dairying in Austria

Betrieb | Tier | Grafik | **Gesundheit** | Admin

↓ Udder health

Bacteriological milk samples

- Number of cows per pathogen – Pattern of pathogens
- Number of cows per pathogen – lactations
- Number of cows per pathogen – lactation stage
- Number of cows per pathogen - reservoir of infection



Example 1: Farm XY

Number of cows per pathogen
Pattern of pathogens
Display of results of bacteriological milk samples last year

Period: 09.09.2015 till 09.09.2016

Number of cows: 8

Staphylococcus aureus

Udder quarter	Animal	ID_Nr.	Sampling Date	Days in milk	Lact.
HR	GLOCKE	AT 999.123.123	30.08.2016	259	2
HL, FL, FR	NENI	AT 999.321.321	04.02.2016	274	3
HR, FR, FL	GUNDI	AT 999.123.321	04.02.2016	242	5

Bacteriological milk analyses
Examples of use for herd management

Comet K-Projekt ADDA

Advancement of Dairying in Austria

Betrieb | Tier | Grafik | **Gesundheit** | Admin

↓ Udder health

Betriebsnummer 721077 Name Mar

↓ **Bacteriological milk samples**

- Number of cows per pathogen – pattern of pathogens
- Number of cows per pathogen – lactations
- Number of cows per pathogen – lactation stage
- Number of cows per pathogen - reservoir of infection

Example 4: Farm XYZ

Number of cows per pathogen - Reservoir of Infection
Display of results of bacteriological milk samples last year
Period: 18.09.2015 till 18.09.2016

Number of cows: 22

Terminology and grouping?

		contagious pathogens			Intermediate ???			environmental pathogens			
		MYKO	SAG	STAPH	SDY	KNS	SUB	ECO	ENBA sp.	STREP sp.	OTHERS
Farm current state	Nr. of cows	0	0	2	4	2	3	0	0	0	1
Farm previous year	Nr. of cows	0	1	3	1	2	4	3	1	3	0

Genetic aspects

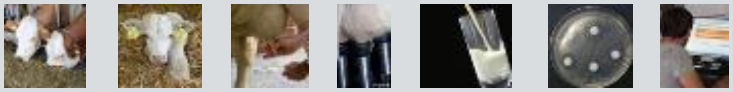
Use of results from bact. milk samples for herd management (Suntinger et al. 2017)

Results on heritabilities

		h^2 (SE) linear model	h^2 (SE) threshold model	comparison of literature*
Staph. aureus	pathogen-specific traits	0.002 (0.001)	0.061 (0.035)	0.036 / 0.05
CNS		0.001 (0.001)	0003 (0.026)	0.100
Strept. dysgalactiae		0.003 (0.002)	0.049 (0.064)	0.021 / 0.05
Strept. uberis		0.004 (0.002)	0.037 (0.035)	0.,04
E. coli		0 (0)	0 (0)	0.032 / 0.06
Acute Mastitis	clinical mastitis traits	0.017 (0.005)	0.043 (0.014)	-
Chronic Mastitis		0.025 (0.005)	0.086 (0.025)	-
Unspecific Mastitis		0.025 (0.006)	0.036 (0.011)	0.061

*De Haas et al. 2002 / Haugaard et al. 2012

AUT: results based on data from labs before harmonisation – analyses with harmonised data in work



Bacteriological milk samples

Challenges

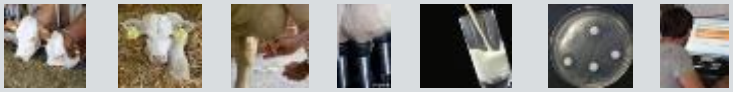
- **False positive results** (false negative ?) **possibilty to filter?**
- **„Benchmarking – comparison of farms “**
  - Criteria for validation

  Problem: heterogeneity in taking samples

  Sampling → Single animals analysed vs. whole farms

  Regular controls vs. sometimes (e.g. at dry off...)
- Grouping of pathogens ? Terminology?
  - contagious vs. environmental
  - major pathogens vs. minor pathogens vs. others

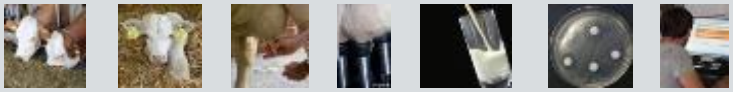
→effective grouping of pathogens? relevant grouping....? necessary for herd management and recommendations



Bacteriological milk samples

Summary

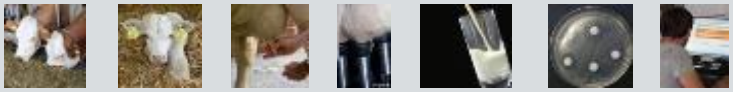
- Results of bacteriological milk sampling valuable information for targeted treatment and herd management
- Potential for genetic analyses
- **Difficulties/Challenges:**
  - Different strategies on farm for sampling (routinely before mastitis, before dry off, partly herd sampling, partly individual cows,..)
  - Harmonized and comparable results
  - Harmonized terminology
  - Unified grouping of codings – for recommendations
  - Comparable panels for testing of antimicrobials resistance are a further challenge



Bacteriological milk samples

Recommendation

- Results of the bacteriological milk samples should be harmonized and recorded centrally
- Valuable for herd management and targeted use of antimicrobials
- Potential use for genetics as additional and more detailed information
- What can be included in ICAR Udder Health Guidelines?
  - Has IDF done work on that ? Terminology?
  - ICAR – set for codes and inclusion in ICAR Health Key?
  - Grouping of pathogens (contagious vs. environement associated; major vs minor pathogens vs other ?)
  - What should be included in guidelines?
- What is valuable for ICAR guidelines?
- How to continue?



Use of bacteriological milk samples for herd management and genetics

Thank you

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