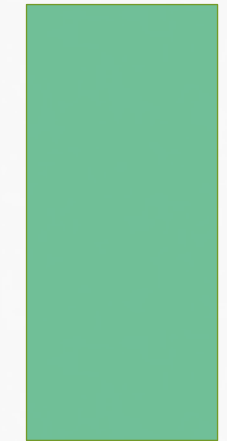


Performance comparison of three different sampling strategies: floqswab™, rayon swab and sponges, for the detection of *Listeria* spp. and *Listeria monocytogenes* in a dairy plant

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**COMMISSION REGULATION (EC) No 2073/2005**  
**of 15 November 2005**  
**on microbiological criteria for foodstuffs**

(22) Sampling of the production and processing environment can be a useful tool to identify and prevent the presence of pathogenic micro-organisms in foodstuffs.

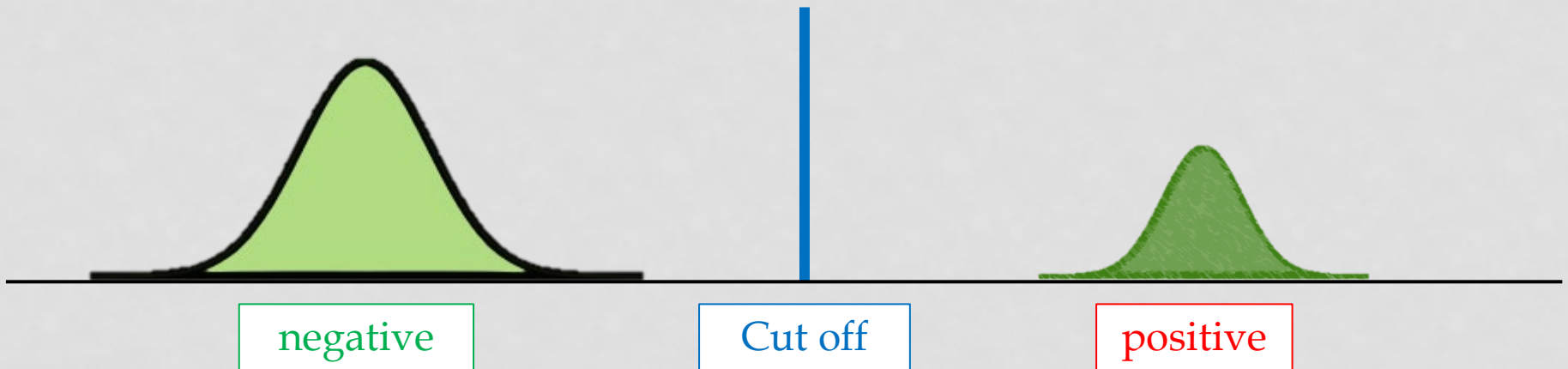
(23) Food business operators should decide themselves the necessary sampling and testing frequencies as part of their procedures based on HACCP principles and other hygiene control procedures. However, it may be necessary in certain cases to set harmonised sampling frequencies at Community level, particularly in order to ensure the same level of controls to be performed throughout the Community.



# ENVIROMENTAL SAMPLING

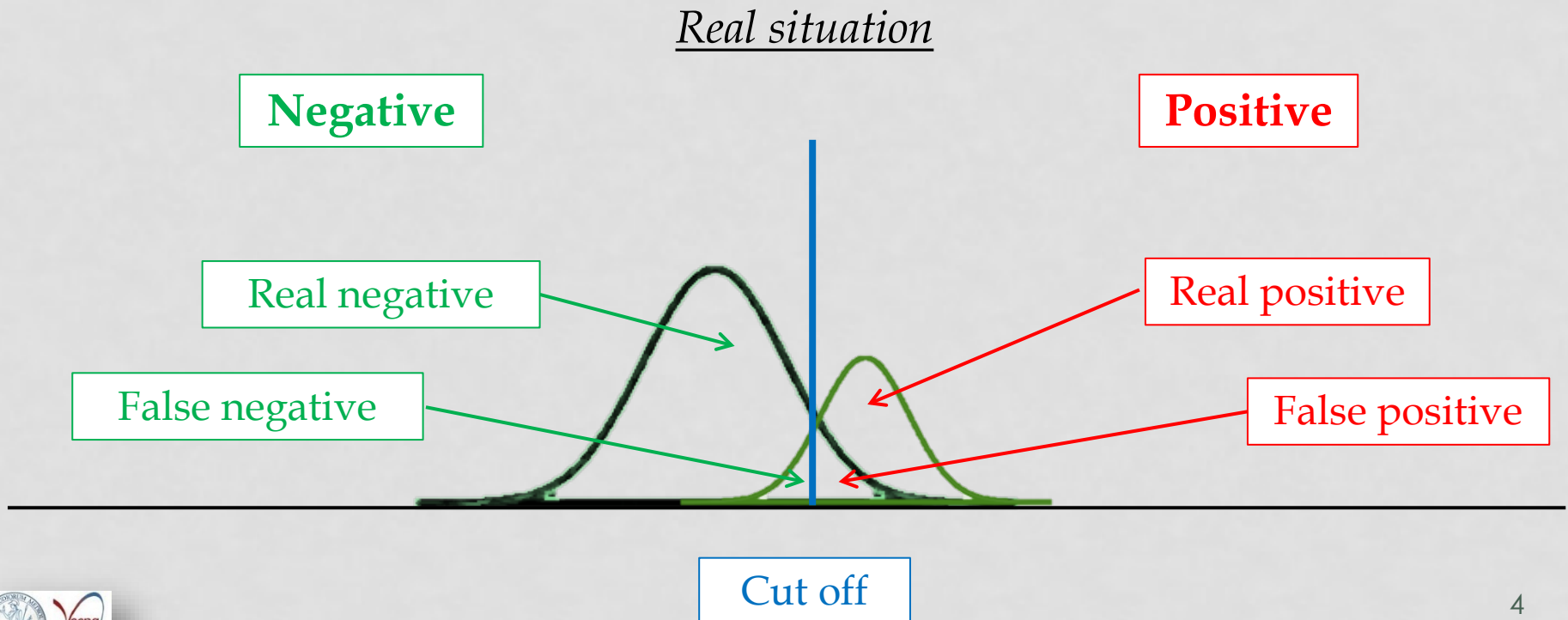
In an ideal situation, a test is expected to be able to perfectly discriminate two non-overlapping (mutually exclusive) populations (positive and negative samples), where the 'cut off' represents the threshold value of the test.

## Ideal situation



# ENVIROMENTAL SAMPLING

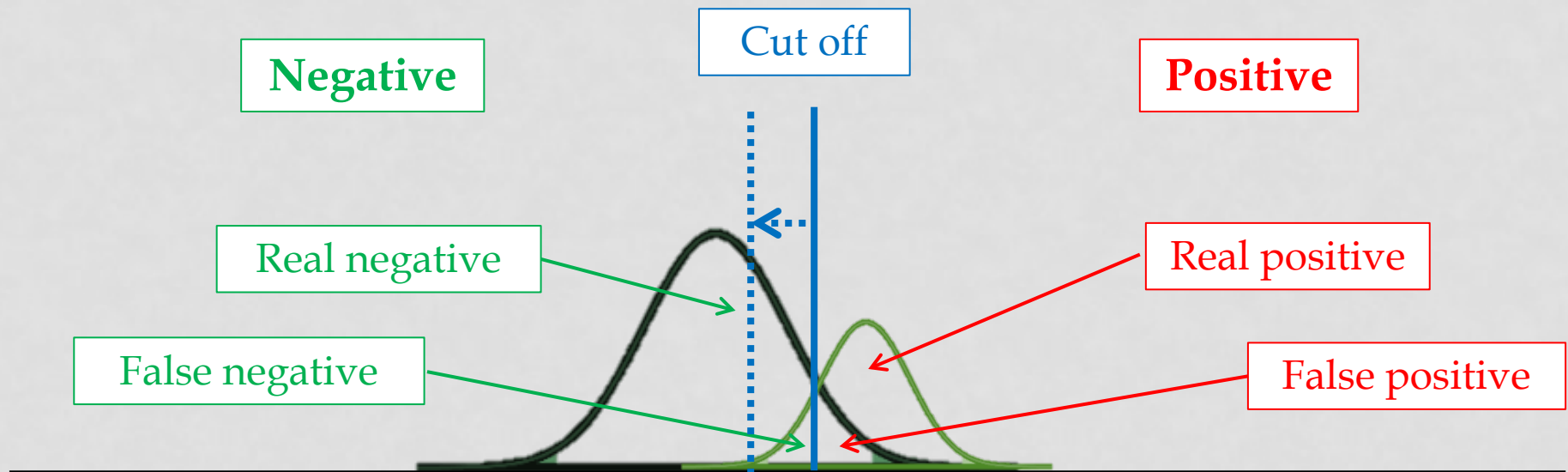
In real situations, it usually happens that the two populations partially overlap, and the test will necessarily identify as positive some samples that are not (False Positive) and as negative some that are positive (False Negatives).



# ENVIROMENTAL SAMPLING

There is no test that clearly distinguishes the two populations (positive and negative).

However, by moving the cut off (sensitivity and specificity of the test itself) it is possible to have an increase or decrease in False Positives and Negatives.



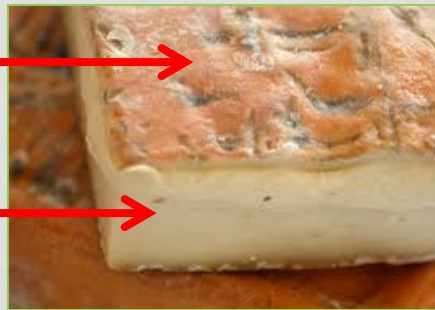
# WHICH ARE THE CRITICAL POINTS IN A DAIRY THAT PRODUCES TALEGGIO CHEESE AND GORGONZOLA CHEESE?

## *Listeria monocytogenes*

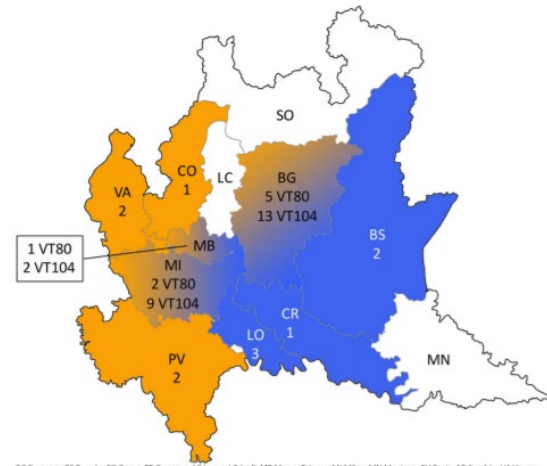
- ✓ Prevalence
- ✓ Colonization of niches in the production environment
- ✓ Environmental persistence
- ✓ Biofilm production

Crust

Paste

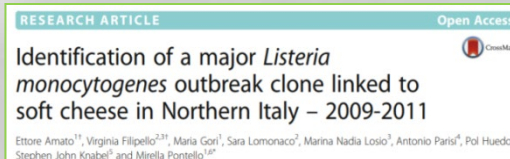


*Taleggio:*  
*Edible crust*



**Fig. 3** Spatial distribution of the 43 ST38 *Listeria monocytogenes* cases in Lombardy (2006–2014). Orange provinces indicate VT80 cases, blue provinces indicate VT104 cases, while gradient provinces indicate both VT80 and VT104 cases.

*Amato et al., 2017*



# AIM OF THE STUDY

Evaluate the performance of FLOQSwab™, rayon swab and sponges in the research of *Listeria* spp. and *Listeria monocytogenes* in a dairy producing Taleggio cheese and Gorgonzola cheese placed in Lombardy





# LISTERIA SPP. AND LISTERIA MONOCYTOGENES

- ✓ Same ecological niches in the industry
- ✓ Same physiological needs
- ✓ The presence of *Listeria* spp. in food = poor hygiene





# CRITICAL FACTORS IN A DAIRY PLANT PRODUCING TALEGGIO AND GORGONZOLA CHEESE?



PRODUCTION:  
T: ~ 26/27°C  
MOISTURE: >90%

**BACTERIAL  
AEROSOL?**

# PRODUCTION LOCALS: CRITICAL FACTORS



**DROPLETS, BACTERIAL TRANSFER?**

# PRODUCTION LOCALS: CRITICAL FACTORS



Product exposure

Points difficult to be cleaned

# PRODUCTION LOCALS: CRITICAL FACTORS

Product  
exposure





# PRODUCT MANIPULATION





**WET AREAS, SPLASHES:  
POSSIBLE PRODUCT / DIRT  
CONTAMINATION**







## HIGH SALINITY ENVIRONMENT, SELECTION OF SOME M.O.





# AGEING: 4/6°C BACTERIAL SELECTION

*Listeria monocytogenes?*



# AGEING: 4/6°C BACTERIAL SELECTION



*Brine rinsing*





# EXPERIMENTAL PLAN



Samples were collected in 3 sessions

## Session 1 and 2:

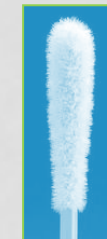
- ✓ 14 and 29 environmental samples for each of the two sessions
- ✓ comparison between FLOQSwab™ and traditional rayon tipped swab

## Session 3:

- ✓ 20 environmental samples
- ✓ Comparison between FLOQSwab™ and sponges



vs



vs



*All the samples were transported and submitted to analyses according to ISO 11290-1:2017.  
Typical colonies were isolated and identified for MID 65 biochemical test*

# SAMPLING POINTS

Production area	Draining area	Ageing area
Drains	Drains	Floor
Floor	Sink	Product surface
Draining channel edge (serum)	Draining channel edge (serum)	Board
Water hose		
Tables (surface-edge)		
Washing area	Packaging area	Brining/salting area
Drains	Pallet	Basin
Floor	Drains	Floor
Sink		Sink
Boxes		

+ Operator's boots/overshoes



# SESSION 1 RESULTS

Listeria spp:  
0% FLOQ Swab™  
0 % Rayon Swab

LM:  
0% FLOQ Swab™  
0 % Rayon Swab

		FLOQ Swab™ L. spp	FLOQ Swab™ LM	traditional rayon L. spp	traditional rayon LM
1	Drenage (milk pasteurization local)	-	-	-	-
2	Duct	-	-	-	-
3	Floor (milk pasteurization local)	-	-	-	-
4	Drenage (production local 1)	-	-	-	-
5	Edge duct (production local 1)	-	-	-	-
6	Duct (production local 2 - gorgonzola)	-	-	-	-
7	Edge Basin	-	-	-	-
8	Duct (production local 3 - ricotta)	-	-	-	-
9	Floor (ageing local 1)	-	-	-	-
10	Floor (ageing local 1)	-	-	-	-
11	Floor (ageing local 2)	-	-	-	-
12	Board (ageing local 2)	-	-	-	-
13	Operator's boots	-	-	-	-
14	Duct (washing local)	-	-	-	-

# SESSION 2 RESULTS

Listeria spp:  
6.9% FLOQ Swab™  
0 % Rayon Swab

LM:  
3.5% FLOQ Swab™  
0 % Rayon Swab

		FLOQ Swab™ L. spp	FLOQ Swab™ LM	traditional rayon L. spp	traditional rayon LM	
1	Drenage (milk pasteurization local)	-	-	-	-	
2	Drenage (milk pasteurization local)	-	-	-	-	
3	Duct	-	-	-	-	
4	Duct	-	-	-	-	
5	Edge table	-	-	-	-	
6	Water hose	-	-	-	-	
7	Drenage (production local 1)	-	-	-	-	
8	Drenage (production local 1)	-	-	-	-	
9	Drenage (production local 1)	-	-	-	-	
10	Drenage (production local 1)	-	-	-	-	
11	Drenage (production local 1)	-	-	-	-	
12	Duct whey	-	-	-	-	
13	Duct whey	-	-	-	-	
14	Duct whey	-	-	-	-	
15	Duct whey	-	-	-	-	
16	Edge basin brine	-	-	-	-	
17	Drenage (local - gorgonzola)	-	-	-	-	
18	Drenage (washing local)	-	-	-	-	
19	Drenage (outside washing local)	+	-	-	-	<i>L. ivanovii</i>
20	Surface cheese	-	-	-	-	
21	Floor (ageing local 1)	-	-	-	-	
22	Drenage (ageing local 1)	-	-	-	-	
23	Floor (ageing local 2)	-	-	-	-	
24	Drenage (ageing local 1)	-	-	-	-	
25	Surface cheese	-	-	-	-	
26	Drenage (packaging local)	-	-	-	-	
27	Drenage (outside packaging local)	-	-	-	-	
28	Operator's boots	-	-	-	-	
29	Wooden pallets	+	+	-	-	<i>L. monocytogenes</i>



# SESSION 3 RESULTS

*Listeria* spp:  
15% FLOQ Swab™  
5 % Sponge

LM:  
10% FLOQ Swab™  
0 % Sponge

		FLOQ Swab™ L. spp	FLOQ Swab™ LM	Sponge L. spp	Sponge LM	
1	Wooden pallets	-	-	-	-	
2	Wooden pallets	-	-	-	-	
3	Drenage (outside washing local)	-	-	-	-	
4	Floor (ageing local 1)	-	-	-	-	
5	Floor (ageing local 1)	-	-	-	-	
6	Drenage (outside ageing local 1)	-	-	-	-	
7	Drenage (outside washing local 1)	-	-	-	-	
8	Sink (washing local)	+	+	-	-	<i>L. monocytogenes</i>
9	Drenage (agein 2)	-	-	-	-	
10	Sink brine local	-	-	-	-	
11	Floor brine local	-	-	+	-	<i>L. welshimeri</i>
12	Sink (production local)	-	-	-	-	
13	Drenage (production local)	+	-	-	-	<i>L. ivanovii</i>
14	Duct whey	-	-	-	-	
15	Sink (milk pasteurization local)	-	-	-	-	
16	Water hose	-	-	-	-	
17	Drenage (milk pasteurization local)	+	+	-	-	<i>L. monocytogenes and L. welshimeri</i>
18	Edge table	-	-	-	-	
19	Drenage (ageing)	-	-	-	-	
20	Operators' boots	-	-	-	-	

# CONCLUSIONS



The FLOQSwab™ improved the recovery efficiency of *Listeria* spp. and *L. monocytogenes* in the dairy plant, leading to suggest the use of this swab typology as a sampling tool for all the places difficult to reach in hygiene procedures of a dairy plant.

# WORK IN PROGRESS



Thank you!