Growth Limits for Dairy Pathogens

Teacheesy

Farmhouse and Artisan Cheese & Dairy Producers European Network

Erasmus+

Growth Limits for the Most Common Pathogens Associated with Dairy Processing

- These tables show the **maximum**, **minimum** and **optimum** values for **pH**, **temperature** and **water activity**, which permit growth (or toxin formation) by several pathogenic bacteria.
- Data for the tables has been drawn from **International Committee on the Microbiological Safety of Foods**

  (ICMSF 1980 & ICMSF 1996), as cited in:

  Institute of Food Technologists (2001) **Evaluation and Definition of Potentially Hazardous Foods**
  Chapter 3: Factors that Influence Microbial Growth
  Comprehensive Reviews in Food Science and Food Safety
  Vol. 2, 2003

Growth Limits and Non-Conformity Management

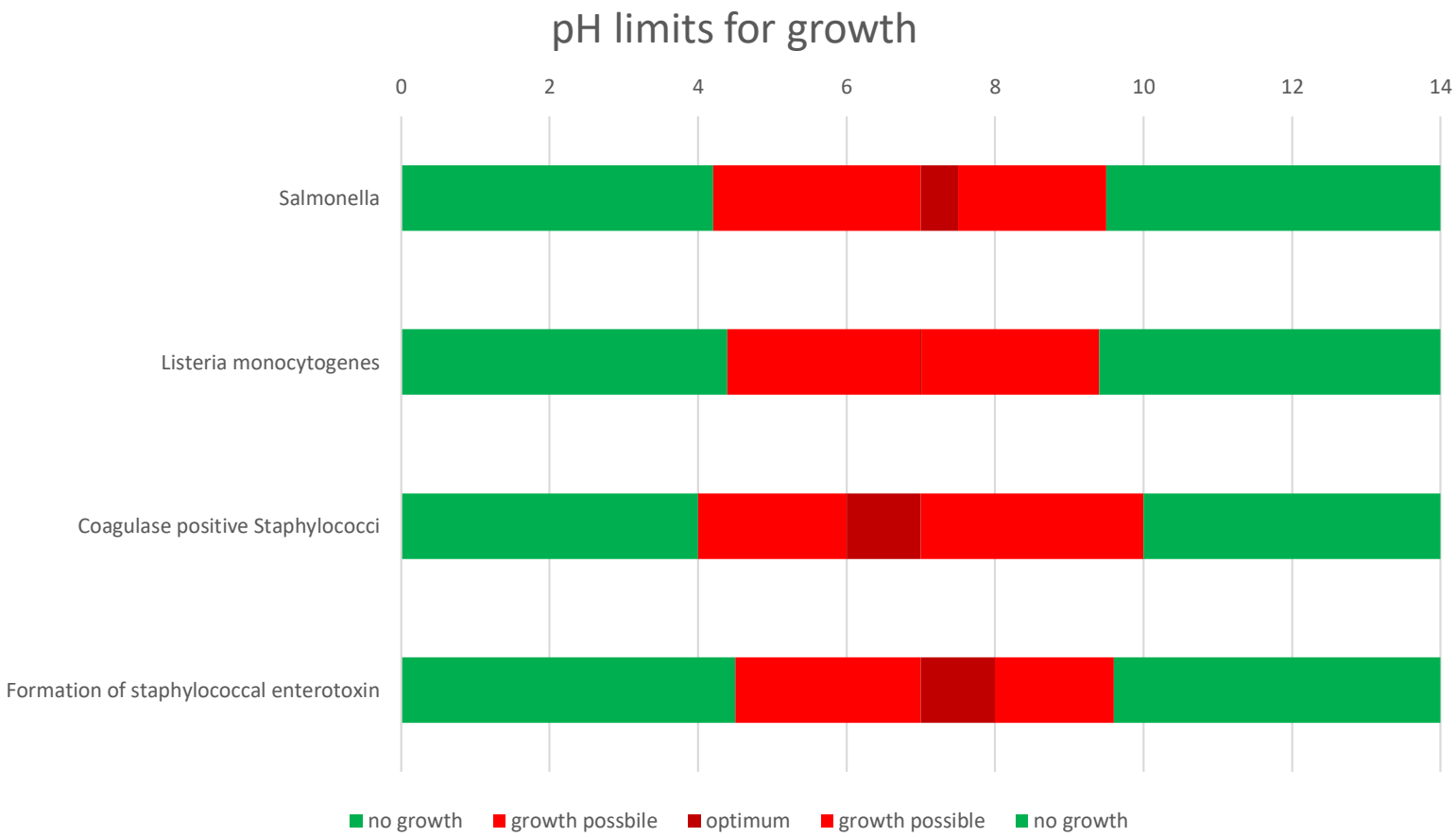
- Where **extended maturation** is used to inactivate a pathogen present in a ripened cheese, the tables can provide examples of **physicochemical parameters** which may be targeted.
- Regulation **(EC) 2073/2005** describes the **minimum** sample number required to assess the **acceptability** of a batch after such treatment.
- Where **heat treatment** is used to inactivate a pathogen, the time-temperature that the product reaches may need to **exceed** that of pasteurisation.
  (for example: 73°C for 1-2 minutes).
- Heat treatment or extended maturation cannot be used to ensure safety in the case of **Staphylococcal enterotoxin.**

Critical Control Points (CCPs) based on growth limits

- It is not possible to **validate** a CCP (such as a target pH) as a means to control growth of a pathogen if the value stated in the **critical limit** is **higher** than the value required to prevent growth.
- Many cheese varieties and other dairy products will have pH values, ripening temperatures or water activity **exceeding** the minimum growth limits for these pathogens.
- Where a **validated** CCP cannot be identified, risk reduction may be better achieved through good hygiene practices during milk production or processing.

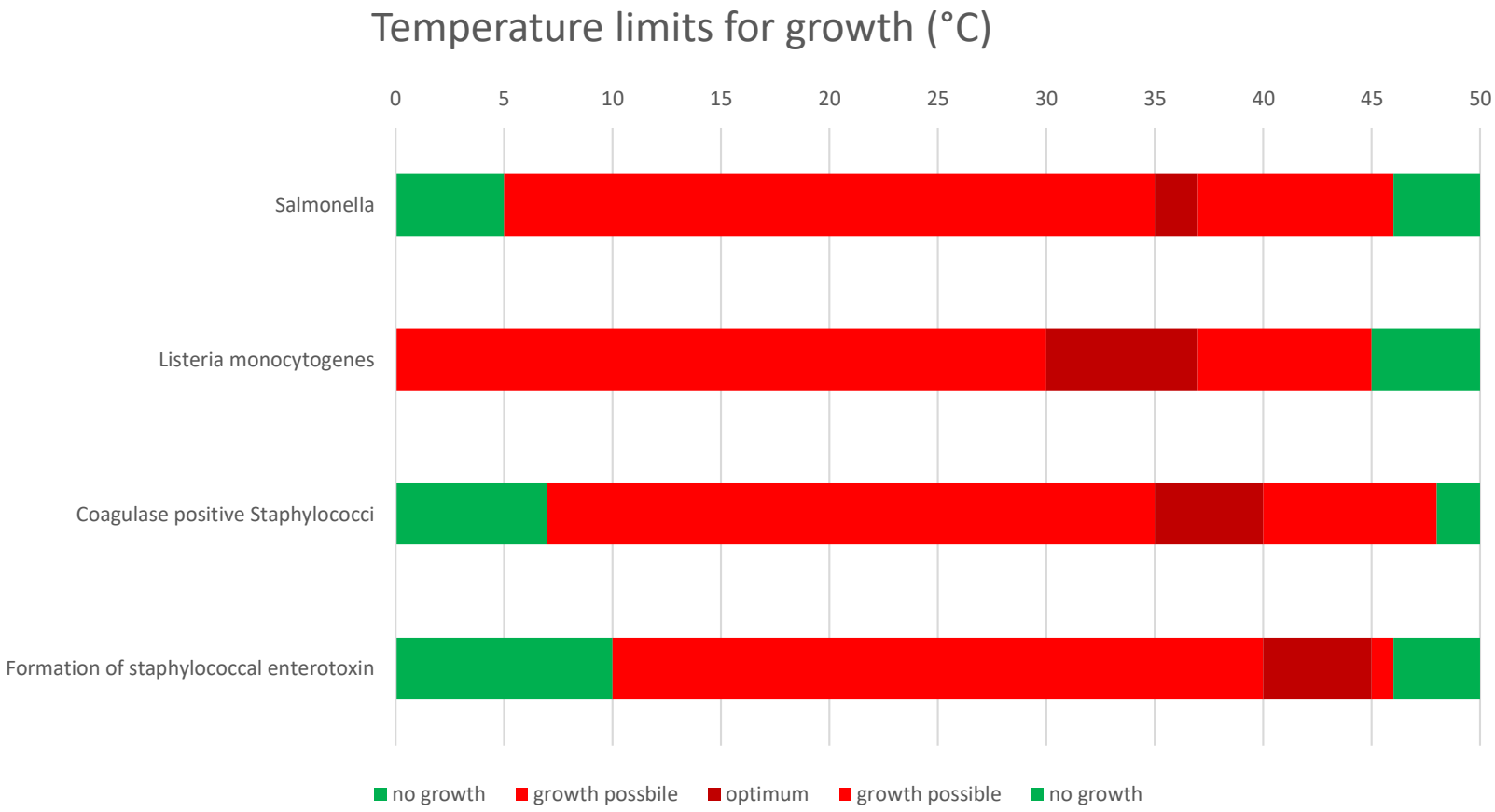
Growth Limits for Food Pathogens (pH)

Organism	Minimum	Optimum	Maximum
Enterohemorrhagic *E. coli*	**4.40**	6.00-7.00	9.00
Salmonella	**4.20**	7.00-7.50	9.50
Listeria monocytogenes	**4.39**	7.00	9.40
Coagulase-Positive Staphylococci	**4.00**	6.00-7.00	10.00
Formation of Staphylococcal Enterotoxin	**4.50**	7.00-8.00	9.60


pH limits for growth
0
2
4
6
8
10
12
14
Salmonella
Listeria monocytogenes
Coagulase positive Staphylococci
Formation of staphylococcal enterotoxin
no growth
growth possbile
optimum
growth possible
no growth

Growth Limits for Food Pathogens (Temperature °C)

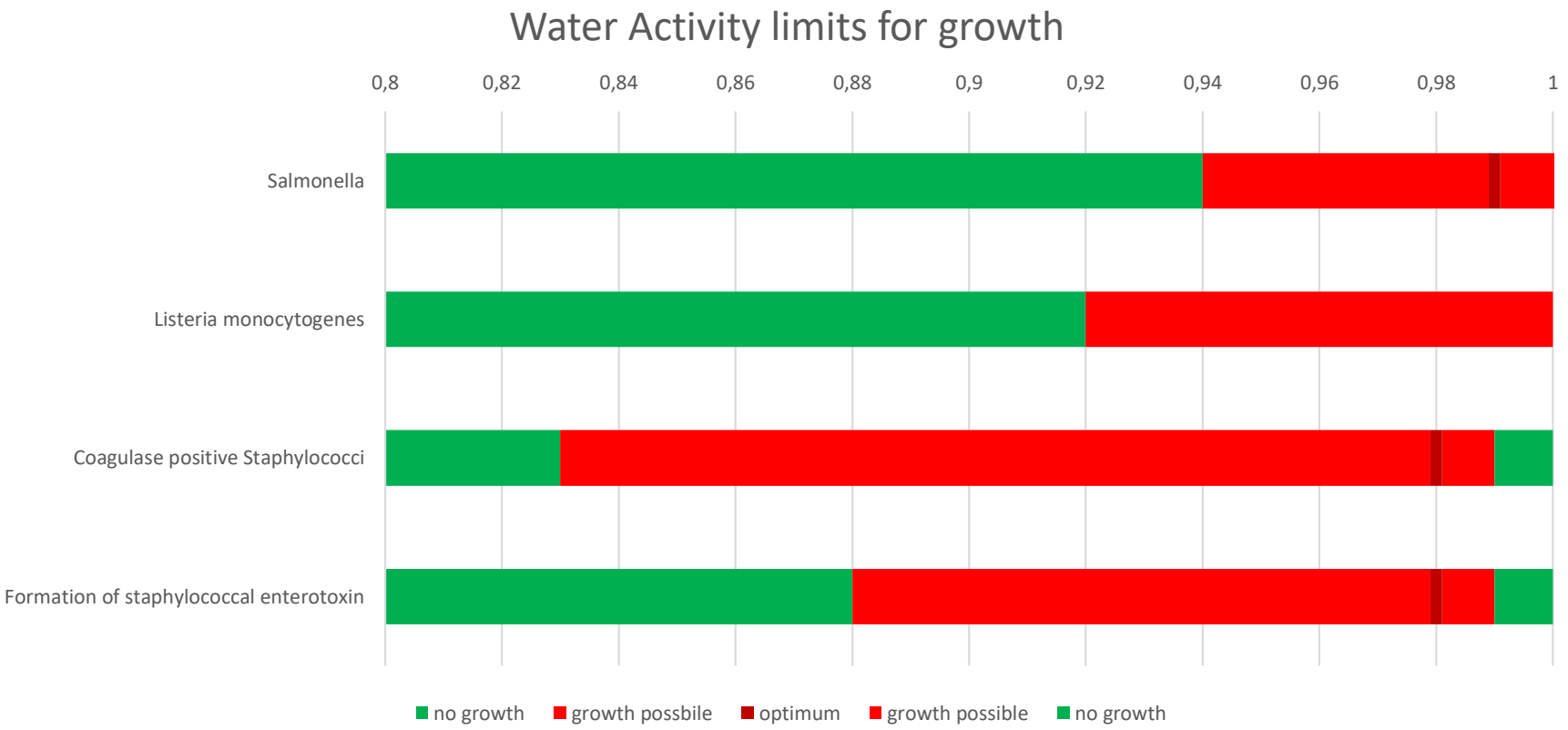
Organism	Minimum	Optimum	Maximum
Enterohemorrhagic *E. coli*	**7.0**	35.0-40.0	46.0
Salmonella	**5.0**	35.0-37.0	45.0-47.0
Listeria monocytogenes	**0.0**	30.0-37.0	45.0
Coagulase-Positive Staphylococci	**7.0**	35.0-40.0	48.0
Formation of Staphylococcal Enterotoxin	**10.0**	40.0-45.0	46.0


Temperature limits for growth (°C)
0
5
10
15
20
25
30
35
40
45
50
Salmonella
Listeria monocytogenes
Coagulase positive Staphylococci
Formation of staphylococcal enterotoxin
no growth
growth possbile
optimum
growth possible
no growth

Growth Limits for Food Pathogens (Water Activity)

Organism	Minimum	Optimum	Maximum
Enterohemorrhagic *E. coli*	**0.95**	0.99	
Salmonella	**0.94**	0.99	>0.99
Listeria monocytogenes	**0.92**		
Coagulase-Positive Staphylococci	**0.83**	0.98	0.99
Formation of Staphylococcal Enterotoxin	**0.88**	0.98	0.99

ICMSF 1996


Water Activity limits for growth
0,8
0,82
0,84
0,86
0,88
0,9
0,92
0,94
0,96
0,98
1
Salmonella
Listeria monocytogenes
Coagulase positive Staphylococci
Formation of staphylococcal enterotoxin
no growth
growth possbile
optimum
growth possible
no growth