

pre-harvest intervention workshop

Case 3:

Other interventions

**„diet manipulation, probiotics (competitive exclusion),
phages, bacteriocines, vaccines“**

Competitive exclusion

Definition: The inevitable elimination of one of two different species with identical needs for resources from a habitat .

Mode of action: Elimination of closely related bacteria by nutritional competition and antibacterial secondary metabolites of CE culture

Current products: e.g. biogen (pigs), broilact (poultry) used against Salmonella/Campylobacter

Competitive exclusion: **Pros and Cons**

- **Pros:**

- Consumer acceptance
- Additional benefits
- Easy application and rather low price

- **Cons:**

- Changing properties of bacteria
- Reproducibility in different microbiomes, in general
- Approval restrictions and availability of products

Bacteriocins: **Pros and Cons**

Definitions: - Ribosomally synthesised peptides with high antibacterial activity
- Produced by different bacterial and archaea

- **Pros:**

- very effective in some animal studies
- no change of the feed palatability

- **Cons:**

- Production costly and labour-intensive
- Stability often insufficient for commercial use
- No products available
- Reproducibility of reduction?
- Application of Nisin just post-harvest (expensive)

Diet manipulation

- ✓ Dietary changes can include addition of phytochemical substances, content of raw protein, lipids, raw fiber or other components of the normal feed
- ✓ Changed diets may result in changed microbiota, viscosity of gut content, histomorphology and gut health, impacting pathogens' colonization.
- ✓ Different feed products, most of them are not targeted against *Campylobacter* and *Salmonella*
- ✓ Conflict of pathogen reduction vs. daily weight gain ←—- ?????
- ✓ Feed acidifiers (poultry, pigs) - inhibit the growth of salmonella and gram-negative bacteria (E. coli)

Diet manipulation

- **Pros:**

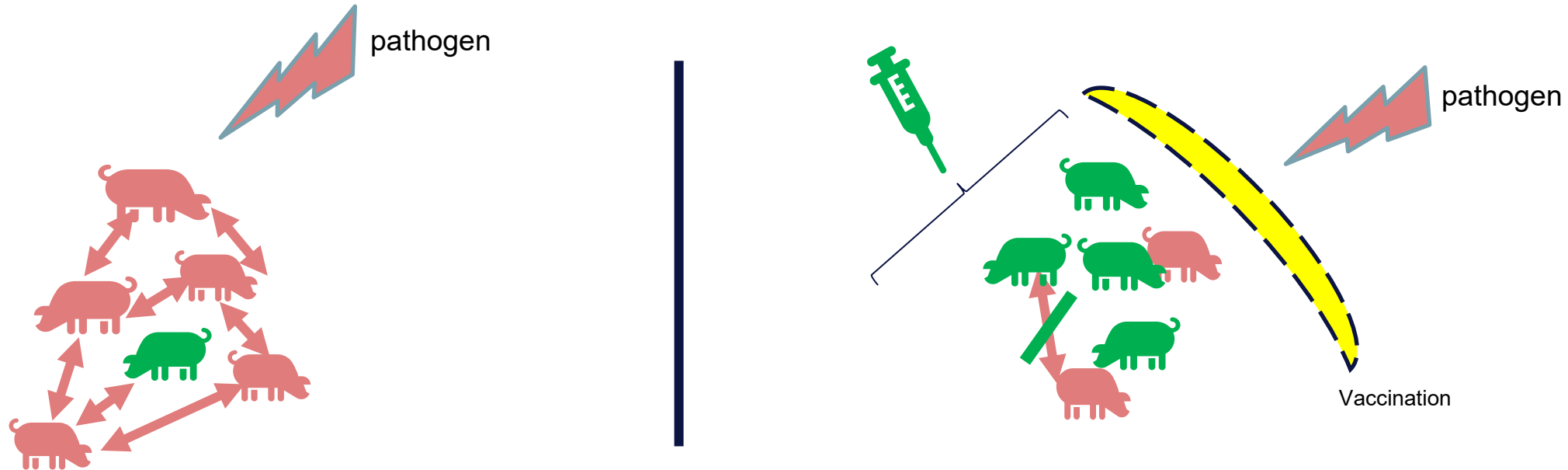
- Easy application and broad use
- Consumer acceptability


- **Cons:**


- Focus of feed composition on health and weight gain
- Effect of feed composition on meat quality and feed intake
- For some pathogens in poultry: reproducible reduction observed
- Availability of supplemented components

Vaccination

- important measure to **prevent infectious diseases** and to **reduce their spread**
- vaccination of the whole herd is required to **interrupt infection chains**



 infected/colonized animal

 not infected/ not colonized animal

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Salmonella vaccination

- Broilers (examples):
 - live freeze-dried Salmonella Enteritidis vaccine – **Salmovac® SE**
 - approved to reduce persistence, shedding and symptoms of S. Enteritidis & S. Typhimurium after infection
- Pigs (examples):
 - double-attenuated Salmonella enterica subsp. enterica sv. Typhimurium - **Salmoporc STM**
 - attenuated Salmonella choleraesuis - **Salmoporc SCS**
 - inactivated Salmonella enterica subsp. enterica sv. Typhimurium, Salmonella enterica subsp. enterica sv. Derby, Salmonella enterica subsp. enterica sv. Infantis – **Biosuis Salm**

Vaccination: **Pros and Cons**

- **Pros:**

- prevention is better than cure
- high herd health results in high animal welfare level and less antibiotic treatments

- **Cons:**

- costly and labour-intensive
- vaccination alone cannot compensate management and biosecurity deficits
- „false-positive“ serological results in antibody based Salmonella monitoring systems
- only few approved vaccines available against zoonoses

Bacteriophages: Pros and Cons

Bacteriophages are viruses of bacteria and highly specific

- **Pros:**

- Consumer acceptance
- Natural inhabitants of the chicken gut
- No changes in surrounding microbiota
- Low toxicity
- On food: no change in organoleptic properties, in US: GRAS
- Rather cheap
- More safe and healthy food
- Limited environmental impact

Bacteriophages: **Pros and Cons**

- **Cons:**
 - Not yet approved in Europe
 - Low consistency of reduction in field studies
 - Resistances occurring (sometimes associated with fitness costs)
 - narrow host range
 - the pathogens may become resistant to their bacteriophage
 - potentially interact with the body's immune system

- Diet manipulation
 - Feed acidifiers (i.e. Salucid)
- Bacteriocines: no products available, but new researches about their use
- Bacteriophages: currently not authorised in Europe
- Vaccination: mainly for laying hens, turkeys and pigs. Not used on broilers and fattening turkeys due to their short life and high cost of the vaccine
 - Poultry:
 - Salmovac
 - Avipro
 - Primun
 - Pigs: Salmoporc

- Diet manipulation
 - Feed acidifiers (Salmacid and others)
- Bacteriocines: no products available
- Bacteriophages: no products available
- Vaccination: several vaccines against salmonella available for pigs and poultry, against Campylobacter not available.

Are these interventions (bacteriophages, bacteriocines, competitive exclusion) the future of controlling zoonoses

- Could be a part of the solution, but there are still open questions and challenges to overcome
- Further studies are needed for official approval of those products
- Additionally, practices in the farms need to be optimised, too
- Shaping microbiome will be easier in the future due to better knowledge and could be the future as studies show that that interventions are able to shape the microbiome according to our needs