



Microbiological Risk

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What can we do?

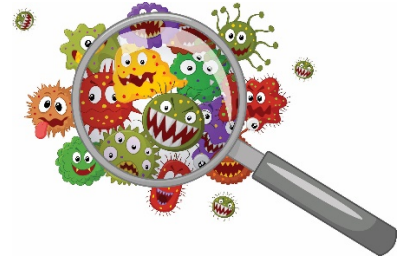
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Microbiological Risk

As we noted in the previous report on risk in food, microbiological contamination is one of the main 4 types of hazards. In this report, we will look at some specific organisms of concern, where they come from, as well as talking about some of the potential controls you can put in place to minimise the risk.



We'll start with the fact that microorganisms (and in particular bacteria) are all around us, on our skin and inside us. Most microorganisms don't cause us any issues, however there are a few that do. These are called pathogens.

The main ones from a fresh produce point of view are bacteria such as *E. coli*, *Salmonella* species, *Listeria monocytogenes*, *Shigella* species, *Clostridium* species, and viruses such as Hepatitis A and Noroviruses. Fresh produce can also become contaminated with parasites such as *Cryptosporidium*.

Escherichia coli

There are 5 different species of *Escherichia*, however, *E. coli* is the most common and has around 190 different strains. *E. coli* is found in the intestines of many animals including humans. There are lots of different strains of them (think different families that share a family tree). Some strains of *E. coli* can cause serious harm (the pathogenic ones) including death in humans, while many others live peacefully in human intestines, aiding in digestion (they can produce vitamin K1).



E. coli may be found in soil from recent animal activity or the addition of compost that has not been properly treated. They are also found in water where this has been contaminated (think cows drinking from a river upstream of where water is abstracted and then used to irrigate lettuces).

Salmonella species

Although there are only 2 official species of *Salmonella*, there are over 2500 different strains. *Salmonella* is also found in the intestines of many animals. Again, there are lots of different strains of them, and as with *E. coli* not all strains are as harmful as each other.



Salmonella may be found in soil from recent animal activity or the addition of compost that has not been properly treated but can also come from bird and pest activity in the field. They are also found in water where this has been contaminated by animals.

Listeria monocytogenes

There are 17 species of *Listeria*, but the main pathogen for humans is *Listeria monocytogenes*. *Listeria monocytogenes* can cause miscarriages in pregnant women as well as food poisoning. It is also especially harmful to the elderly with a higher death rate than in other groups.



Listeria monocytogenes is found throughout the environment, being commonly found in soil, animals and water. *Listeria* likes damp cool places so can survive long periods in chillers.

Shigella species

As with *E. coli* and *Salmonella*, *Shigella* is commonly associated with the intestines of many animals.



Shigella may be found in soil from recent animal activity or the addition of compost that has not been properly treated. It is also found in water as well as cases being linked to poor hygiene of workers – handling fresh produce after going to the toilet without washing their hands afterwards.

Clostridium species

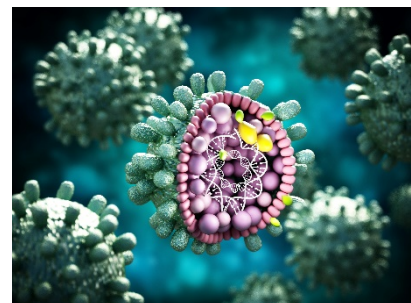
Like *Listeria*, *Clostridium* bacteria are commonly found in soil. There are over 200 different species of *Clostridia*, but the main 2 from a food safety point of view are *C. perfringens* which causes gas gangrene, and *C. botulinum*, which is the cause of botulism which leads to nerve damage and death (also used as a beauty treatment).



Clostridia survive in environments where oxygen has been removed, so can be found in lake beds and deep soil. If disturbed during water abstraction, sediment containing *C. botulinum* can be spread over crops.

Hepatitis A virus

Hepatitis A is a virus that can cause a disease of the liver (hepatitis). It is commonly associated with poor worker hygiene, although it can also be from contaminated water used to irrigate or wash fresh produce.

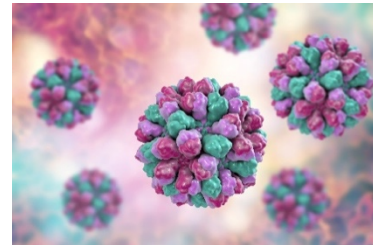




Hepatitis A virus is often found in shellfish and water along with contaminated individuals.

Norovirus

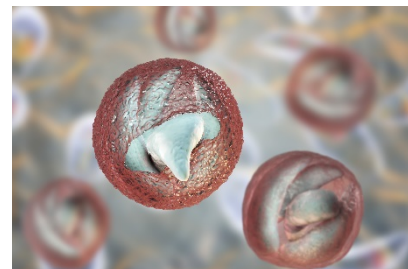
There are around 25 different strains of norovirus that can affect humans. In the USA in 2016, it was reported that there were around 21 million cases of norovirus caused gastroenteritis with more than 70,000 hospitalisations and nearly 800 deaths.



Noroviruses spread through the air and are passed around commonly in situations where ventilation systems are present (think airlines or ships). From a fresh produce point of view, they are commonly associated with salad and fruit that is eaten raw after being prepared by a contaminated food handler.

Cryptosporidium

Cryptosporidium is a parasite found in animals. There are around 40 known species of cryptosporidium with 20 thought to infect humans. Humans become infected through eating contaminated items. Commonly associated with fresh produce which becomes contaminated either through the soil, or through irrigation/wash water. It can also be spread through person to person contact after touching animals (often found at farm parks).



So, what can we do?

In simple terms, we will not (nor should we try) to destroy all bacteria, viruses and parasites. However, we can reduce the risk of our fresh produce being the source of an issue through some relatively easy actions.

What Crop?

Let's start with what crop are you intending to grow. Crops such as potatoes and swede that are not often eaten raw, are less likely to cause food poisoning/food borne infections, than ready to eat crops (such as salads and soft fruit). This doesn't mean you can ignore hygiene for potatoes, but the risks are less, and fewer controls are required.

If you are growing salad crops or soft fruit, then you need to minimise the risks you can.

Fields

Look at your fields and assess risks before you plant anything:

- Have animals grazed on their previously,
- Has untreated animal manure been applied,
- If the field is at the bottom of a slope, could water run into the field. If it could, are animals grazing above the field?
- If you are going to irrigate the crops, where does the water come from.
- If you are wanting to add animal manure to the fields, can it be properly composted first, so it reaches $>55^{\circ}\text{C}$ for more than 9 days, with the compost begin turned at least 3 times so all of it gets heated.
- Is the field a haven for wildlife? You may not be able to get rid of all animals, are you can't stop birds flying over fields, but you can put up fences to keep larger animals (and humans) out. If you can grow your crop in a covered environment (tunnel or glasshouse) this will dramatically reduce the risk.
- Is the field next to a river which can flood? Flood water often carries large quantities of sewage and other contaminants. These can be left on fields which can then contaminate crops.

Water

If you are going to irrigate the crops, where does the water come from.

- If it's from a borehole, is the pump/well covered with no animals grazing around it.
- If the water is coming from a river, what goes on upstream?
- Have you tested water previously, routinely?
- You can filter or treat water with UV or chemicals, however this is expensive, so is normally only performed for high value/high risk crops.

Workers

The main control you can easily implement is worker health and awareness of hygiene.

- Do you have a hygiene policy for your field staff?
- How far is the toilet away and do they use it (or do they use a hedge instead)?
- Have they been trained in hand washing and reporting of illness?
- Do you check that hand washing is being performed or is it just assumed it is?
- What are your medical controls for staff reporting sickness or diarrhoea?

Equipment

Depending upon what you are growing, the crop will determine the equipment requirement for harvesting. This may be as simple as a small knife, right up to a complex multirow baby leaf harvester.

Knives can easily be cleaned and checked on a daily basis, however, to fully strip and clean/disinfect a baby leaf harvester takes time and a skilled resource.

Different crops can be harvested both mechanically and by hand (e.g. Brussel sprouts). Identifying the risks in each option may swing your choice of harvesting method.

We can't eliminate the risk of microorganisms contaminating fresh produce, particularly when they are grown in open fields. However, by implementing controls such as the ones identified above, we can minimise the risk.