Factsheet 4: Projected Climate-related Impacts on Food Safety/Systems in the Horticulture Sector

RISK MATRIX

The risk matrix represents a sector specific overview of the climate change impacts to food safety and systems, their risk now, in the future under a high emission scenario, and following suggested adaptation options. The risks are defined as low = green, medium = yellow, high = orange, high = red. Information used to develop the risk matrices was sourced from scientific publications and industry feedback from Workshop 1 and based on the high emission scenario. The purpose of the risk matrix is to provide a summary of potential impacts for discussion with representatives from the NZ food sectors, research providers and government agencies.

Issues have been categorised as follows:

Category 1: Existing hazards affected by climate change

- Those arising from infectious agents
- Those arising from naturally occurring chemicals and biotoxins

Category 2: From risk management to address climate change issues

- Chemical interventions (pesticides, antibiotics etc.)
- Other changes in production processes

We have based our indications of climate change expected over the next 100 years on the highest representative concentration pathway (RCP) 8.5, because this enables us to more clearly assess future change.

Additional commentary is provided below the table.

CLIMATE CHANGE AND FUTURE IMPACTS

Extreme events are likely to increase and include:

- Frequency, duration and intensity of hot spells;
- Frequency of heavy precipitation events and the potential for associated flooding;
- Incidence of extremely high sea levels during storm surges;
- Longer dry spells in some areas (especially in the north of the North Island and east of both islands), and the area affected by drought each year, are likely to increase;
- Cold spells and frosts will decrease in frequency, duration and intensity (Solomon et al 2007).

Changes to the average climate will include:

- Most areas of New Zealand will experience increased average crop and pasture yields associated with anticipated mean temperature rises of 1–3°C;
- Average annual rainfall in New Zealand will generally increase in the south and west and generally decrease in the north and east of the country, with seasonal variations.
- The winter season is projected to have the greatest rainfall changes (an exacerbation of the annual changes), as westerly winds (particularly across the South Island) are likely to strengthen. Together with warmer temperatures, this is likely to have a significant effect on winter cropping and pasture production.
- Average relative humidity is likely to increase for most areas of New Zealand.
- By the end of the 21st century, mean growing season temperatures are highly likely to equal current extremes in temperate areas (including New Zealand) and to exceed them in the tropics and subtropics, resulting in major impacts on global food production (Battisti and Naylor 2009).

FOOD SAFETY SYSTEM ISSUES

The impacts of global climate change on food systems will be widespread and complex

- Scientific consensus says that individual pathogens will differ widely in epidemiological responses, the net impact of climate change will lead to a large increase in the burden of infectious diseases (Costello et al 2009).
- For plant-derived foods including stock feed, mycotoxins are considered the key issue for food safety under climate change (Tirado et al 2010).
- Rising incidence of disease will lead to overuse or misuse of pesticides and veterinary medicines, particularly in fisheries (Miraglia et al 2009; Solomon et al 2007; Tirado et al 2010).

Specifically for NZ's Horticulture Sector:

ADAPTATION OPTIONS

At the farm level

- Greater deployment of water conservation technologies
- Improved management of pests and diseases,
- Shift in production to areas more suitable
    - the importance of frosts and winter chill for production which may reduce in more northern parts of the country
    - movement of crops to wetter areas
- Shift towards more C4 plants

- Treatment of water used for irrigation
- Use of new resistant commercial crop types and/or new species
- New biocontrol agents may be required
- Water security measures or movement to areas with more reliable rainfall/water supply
- Natural plant growth promoters

At post-harvest/off-farm level

- Improvements to food cleaning, handling and storage

CASE-STUDY: *Escherichia coli* on leafy greens and tomatoes

Heavy precipitation events, as a result of climate change, may result in contamination of some food plants such as leafy greens and tomatoes (Park et al 2015; Kniel et al 2017). Contamination may occur by splashing of faecal matter, by runoff from neighbouring fields where livestock graze, or irrigation with contaminated water (Mootian et al 2009). Amended soils containing manure have also been shown to cause contamination events. Increased temperatures and drought conditions as a result of climate change may lead to an increased use of amendments for poor soils.

After a contamination event additional growth of *E. coli* may occur as a result of increased temperatures and high humidity. For example field trials in Atlanta examined the transmission and growth of *E. coli* on tomatoes from a one-off irrigation event using water contaminated with faecal matter (Kniel et al 2017). Spikes of *E. coli* levels were observed following the contamination event suggesting that there was additional growth. *E. coli* may be internalised within the plant and in this case cleaning and sanitisers are unlikely to be effective adaptation options (Erickson 2012); therefore the prevention of contamination events using adaptation options around water security measures and land management practices (e.g. around the application of fertiliser) will be essential.

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