AUGUST 2021

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Photo by Adrian RA on Unsplash

WHAT CHANGES TO EXPECT- INTEGRATED CROP PROTECTION

KEY MESSAGES

In this global scan we look at some of the changes affecting the integrated crop protection tools available to vegetable growers by examining what is happening elsewhere, globally and in other sectors.

Based on international developments, we can expect continued deregistrations and restrictions on allowable synthetic chemical use that will affect vegetable production in Australia. This global scan describes restrictions/deregistrations that have occurred internationally and how the industry has dealt with them. It examines some of the reasons for restrictions and makes suggestions about how vegetable growers can prepare for possible changes in Australia. Many of the potential answers lie in building resilience, in our soils, in our need for energy and water, in the ecosystems that we operate in, and in continuing to develop synergistic approaches.

Vegetable growers have an opportunity to try different ICP and soil health management approaches now and drive well co-ordinated research, development and extension (RD&E) to develop the required ICP system approaches before any future imposed changes.

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FOCUS OF THIS GLOBAL SCAN

This global scan gives some indication of what regulatory changes may occur for vegetable producers.

INTRODUCTION

Various factors can impact the economics of vegetable production such as weather, markets, input costs, labour availability and costs. Here the focus will be on the control of pests (insects), diseases (viruses, bacteria, protozoa, fungi, nematodes) and weeds, and potential changes that may impact your business.

One of the major contributions to being prepared for change will be knowledge and monitoring (see Figure 1) – **'monitor to manage'**.

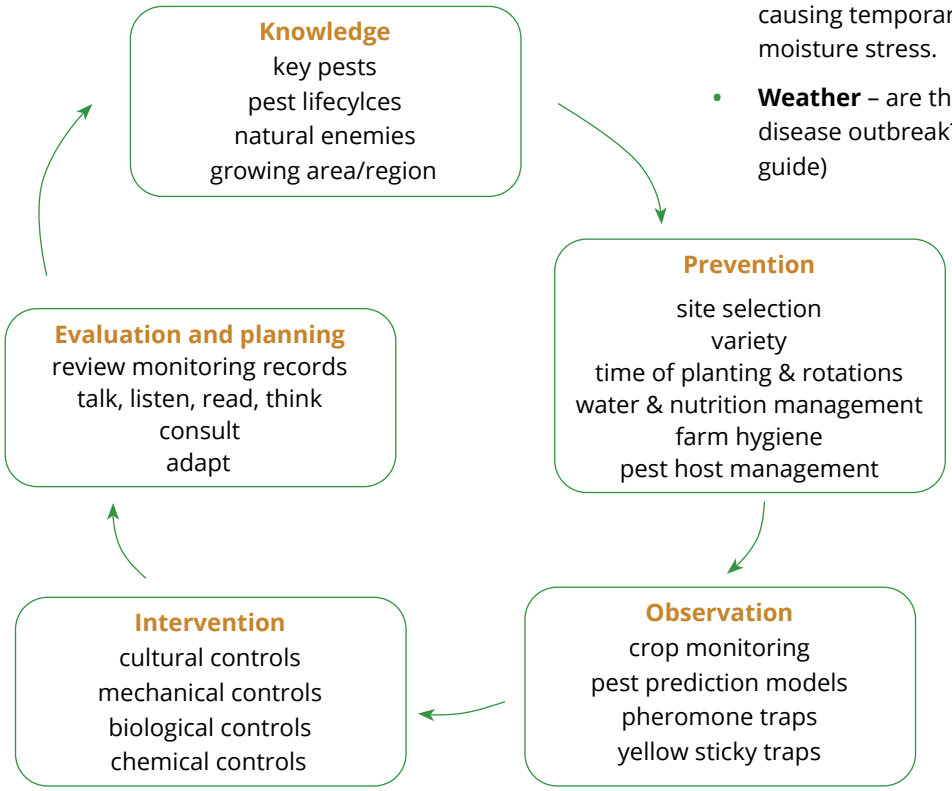

Figure 1. Integrated Pest Management model of continuous improvement

What are the current conditions? What is the trend? What does this infer for future management? What do you need to change? What do you need to keep the same? This will help you to know where you are at and what is going on.

What should be monitored and recorded:

- **Soil condition / soil health** - soil is not compacted, cloddy or powdery after tillage and doesn't tend to slump and go really sticky when wet.
- **Nutrients** – have a nutrient management plan that is site specific and balanced. Include regular checks of soil and crop nutrient status (soil testing, sap or dry matter analysis), include regular monitoring, talk to your agronomist
- **Soil moisture** - crops should not be over-irrigated causing temporary waterlogging or suffer from moisture stress.
- **Weather** – are the conditions conducive to pest/ disease outbreak? (see Leaf and Stem disease guide)
- **Crop health** - systematic scouting for pests and diseases, both known and new ones. Identification and removal of weed hosts, ensuring there are 'homes' for beneficials.
- **Market** – what new regulatory requirements are on the horizon in your current (and any future) markets?

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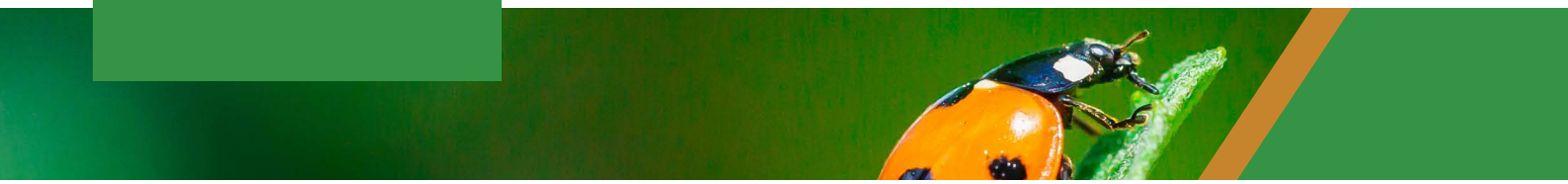
SoilWealth NURTURING CROPS — Integrated Crop Protection PROTECTING CROPS



WHAT IS IPM/ICP?

There are various phrases used to refer to **protecting vegetable crops in an integrated manner**. In Australia, the terms include Integrated Pest Management (IPM) for insect pest control and Integrated Crop Protection (ICP) for an overall approach. **In the European Union (EU) and the United States (US), the term 'pest' refers to pests and diseases and so IPM includes managing weeds along with all the other pest and disease groupings (see Table 1)**. This broader definition of pest has been adopted throughout this document.

The text boxes on this page and Tables 2 and 3 and Figure 2 on the following page give a very brief overview of the philosophy and practical application of integrated crop proteciton techniques and possibilities as a vegetable producer.

A number of factors contribute to plant health (see Figure 2), with many of them interacting (e.g. weather influencing likelihood of fungal disease). Growers are able to influence many of these factors through their practices.

Photo by Gabriel Jimenez on Unsplash

Integrated crop protection is based on understanding and using interactions between all factors that impact on crop heath and productivity:

- **Choice of variety** – suitable to the soil and climate, preferably with genetic pest resistance or tolerance
- **Managing soil condition** – the chemical, physical and biological function and balance of a soil within its given features (texture, soil type, location in the landscape)
- **Reducing the use of crop inputs that have strong or lasting effects,** particularly on soil conditions such as pH, EC, microbial abundance or balance, structure, organic matter and nutritional status
- **Managing soil moisture** - irrigation, drainage and soil condition ensure that the soil is well aerated.

Ecology is the study of relationships between plants, animals, people, and their environment - and the balance between these relationships.

Agroecology is the application of ecological concepts and principles in farming.

Regenerative agriculture is a conservation and rehabilitation approach to food production systems. It focuses on strengthening soil health via topsoil regeneration, increasing biodiversity, improving the water cycle, enhancing ecosystem services, supporting carbon sequestration, and increasing resilience to climate change.

Table 1. Scope of terms 'pest', 'IPM' and 'ICP' in various regions

region	term	bacteria/ viruses	protozoa	fungi	nema-todes	insects	weeds
Australia	disease	✓	✓	✓	✓		
Australia	pest					✓	
Australia	Integrated Pest Management (IPM)					✓	
Australia	Integrated Crop Protection (ICP)	✓	✓	✓	✓	✓	✓
EU & US	pest	✓	✓	✓	✓	✓	✓
EU & US	Integrated Pest Management (IPM)	✓	✓	✓	✓	✓	✓

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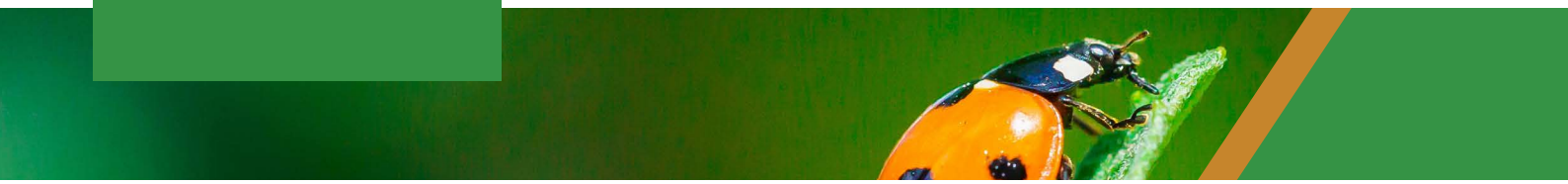

Table 2. Control options available for various lifeforms

control options	viruses	bacteria	protozoa	fungi	nema-todes	insects	weeds
chemical	not directly	extremely limited	unsure	✓	✓	✓	✓
cultural	×	✓	✓	✓	✓	✓	✓
resistant cultivars	✓	✓	unsure	✓	unsure	✓	n/a
good plant health	y (if it deters insects)	✓	✓	✓	✓	✓	✓
good soil health	y (if it leads to good plant health)	✓	unsure	✓	✓	✓	✓

Table 3. Are there insect vectors for various lifeforms?

	viruses	bacteria*	protozoa	fungi	nema-todes	insects	weeds
insect vectors?	✓ (many)	limited (leafhoppers, psyllids)	✓ (all)	✓ (some)	✓ (some)	n/a	y (some carry pollen, etc.)

*Perilla-Henao & Casteel (2016)

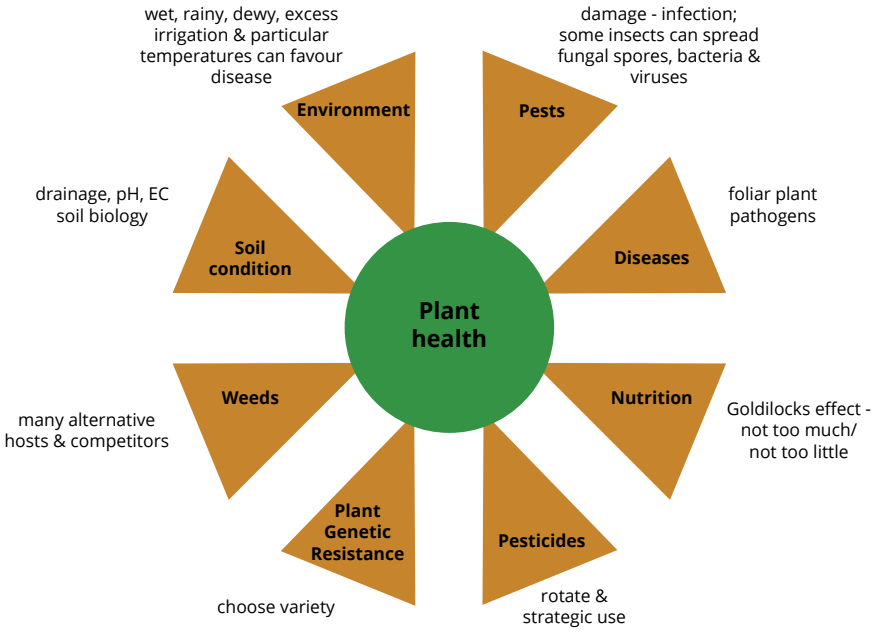

Figure 2. Effects on plant health that a grower can influence (courtesy Dr Len Tesoriero, adapted and used with permission)

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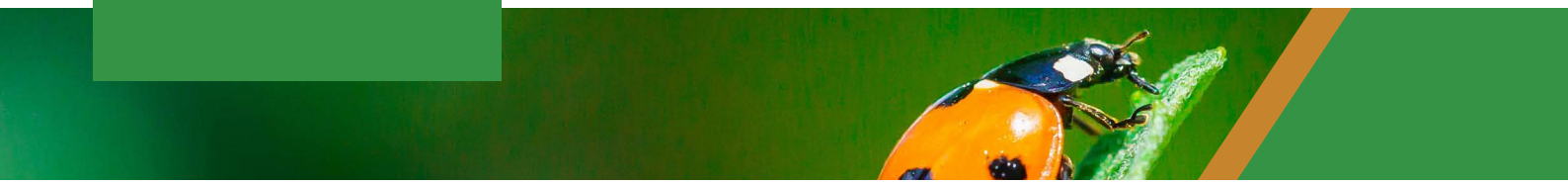

DRIVERS OF CHANGE IN CROP PROTECTION

Synthetic chemical use in agriculture

In the post-World War II era, **agrochemicals** were seen as a panacea, there was one to fix every problem – from antibiotics, fungicides, vermicides, insecticides to herbicides. Most were broad spectrum products, killing pests and diseases along with beneficial organisms. Gradually it became obvious that there needed to be **care in their use and application** – resistance and decreasing efficacy occurred for many of the chemicals. Some had unwanted effects on the environment or people. Smarter use and integration into holistic plans to minimise damage to the crop and non-target organisms, and maximise yields became more widespread. As Schellhorn et al. (2009) put it, the approach was to **'maximise the total benefits and minimise the harmful side effects that can arise from the exclusive use of chemical pesticides'**.

Wider social drivers of change

While chemical use, especially use of broad spectrum products, has decreased, there are now further market-driven influences pushing for decreasing their use. Among these are the changing views on **the impact of climate change on our natural environment** and **a growing social movement to find ways to limit people's impact on that environment.** This includes public views on the role of plant production inputs. This change in community philosophy from acceptance of chemical intervention to one of **environmental stewardship** has widespread implications. Changes in policy, social licence to operate, resource use efficiency expectations, and accounting for carbon emissions and sequestration are having a flow-on effect on agricultural production systems including growing vegetables.

Food safety

There is also a greater focus on food safety with market pressure for organic and hormone/antibiotic and residue free products and associated labelling.

There have already been changes and market access restrictions due to phytosanitary measures such as maximum residue levels (MRLs) for pesticides.

International drivers

The United Nations 17 Sustainable Development Goals are providing a framework for strategic thinking at all levels – international, national, corporate, business and individual. **"The commons"** – resources that are shared and used but not owned by one entity – is likely to undergo changes in governance/regulation, think for example water, air, biodiversity/ecosystems. Changes brought about through these are likely to flow down to changes at a national, state and local level that affect producers.

Australia is already a signatory to conventions such as the Rotterdam Convention (restricted pesticides and industrial chemicals) and the Stockholm Convention (persistent organic pollutants). Australia **ratifying further future conventions** could regulate other trades and practices.

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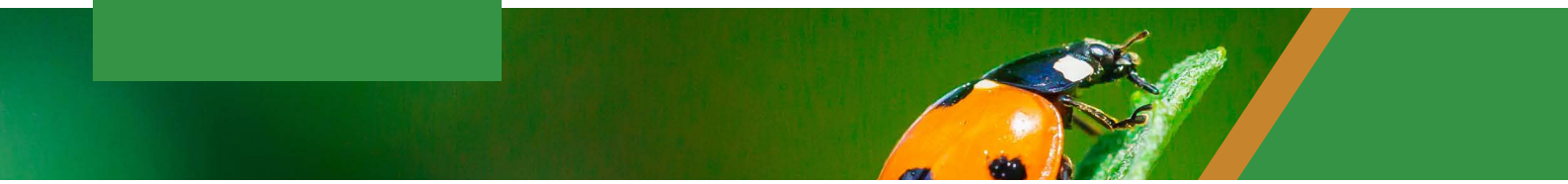

Examples of international restrictions and bans

Methyl bromide

Methyl bromide has been used as a soil fumigant internationally. Due to its ozone-depleting properties, its global use was reduced incrementally under the Montreal Protocol (on Substances that Deplete the Ozone Layer). **Since January 2005 its use has been largely illegal in the US**. There are critical use and quarantine exemptions. Australia's position is very similar.

In the EU, methyl bromide use was also banned in 2005, with critical use/quarantine exemptions expiring in 2010.

Steam sterilisation, IPM techniques and controls such as pheromones, electrocution and light traps, as well as a focus on soil health management, were suggested as alternatives to methyl bromide use.

In some fruit production (e.g. strawberries), the methyl bromide restrictions could arguably be responsible for a change in production system – to hydroponics or soil-less growing media.

Glyphosate

Many countries or cities/states within countries **have some form of ban, phasing out or restrictions on the use of glyphosate**. Countries include Saudi Arabia, Oman, Qatar, Kuwait, Bahrain, the United Arab Emirates, the Netherlands, Luxembourg, Austria, Germany, Italy, Mexico, and Thailand. There are also countries where bans or restrictions have been rescinded – Sri Lanka, Brazil. **A ban on use of glyphosate in the EU will come into effect on 15 December 2022.**

Metham sodium

Increasingly vegetable growers have been finding that fumigation with metham sodium is less and less effective. Its use is selecting for microorganisms that are able to break down the product's active ingredient and some organisms also develop resistance. This is leading to increased pest and disease problems and decreased productivity. Growers are increasingly turning to other methods of keeping soil healthy, such as compost, cover crops, biofumigant cover crops and reduced tillage.

Synthetic pesticide bans

The Indian state of **Sikkim**, which sits between Nepal and Bhutan, **banned synthetic pesticides in 2014**, after initiating the transition in 2003, citing pesticide residues in fish, vegetables and rice, and "a spike in cancer rates in industrial farming areas". As of 2018, 190,000 ha of farmland was certified as organic. Other Indian states contemplating taking the same route include Kerala, Uttakarand and Meghalaya.

Bhutan, the only country with a complete ban on synthetic pesticides, **is intending to have converted to organic production by 2023**.

On 13 June 2021, over 60% of **Swiss voters** rejected 1) a **complete ban on synthetic pesticide use** and 2) stopping of direct subsidies to farmers using artificial pesticides and antibiotics (for livestock). The second initiative was seeking to protect drinking water quality. **While the majority of the population rejected the ban, 40% supported it**.

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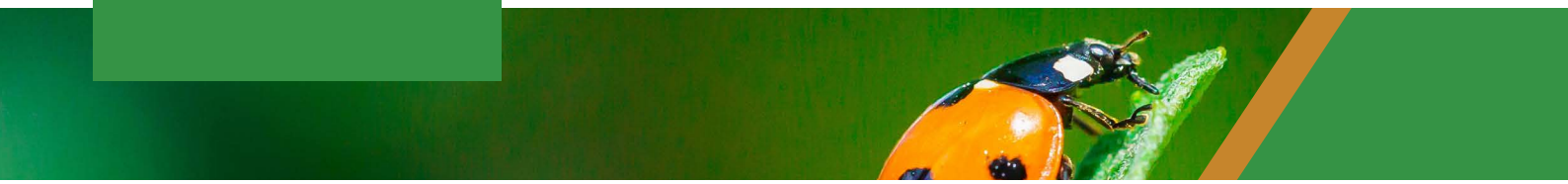

EXAMPLE OF AUSTRALIAN INTRODUCTION OF GUIDELINES

The Reef Program – Australia

In 2010, the Great Barrier Reef Marine Park Authority (GBRMPA) released **Water Quality Guidelines** for the Great Barrier Reef Marine Park in response to concerns that catchment run-off was adversely affecting the World Heritage Area. The **Guidelines focussed on sediments, nutrients and pesticides**.

Water quality targets were set for each catchment. Risk frameworks were developed for the major impacted agricultural sectors. The **horticulture risk framework** focusses on soil, water, nutrient and pesticide management with examples of innovative, best, minimum standards and superseded practices.

Extension has been integrated with a monitoring program to encourage adoption of best practice. Alongside this are changes to the state Environmental Protection Act that set pollution load limits and minimum standards. Best Management Practice programs have been developed for cane, bananas and horticulture.

The Queensland government is working with various certification agencies (e.g. Freshcare) to develop pathways for producers to be able to demonstrate they meet the Reef protection regulations.

AUSTRALIAN-GROWN HORTICULTURE SUSTAINABILITY FRAMEWORK

Hort Innovation has developed the **Sustainability Framework** to benchmark and track measures and indicators of sustainability. It is envisaged these will be used at all levels to provide focus for improvement and evidence of sustainable operations. The Framework has been mapped against UN Sustainable Development Goals and Global Reporting Initiative standards.

The framework has four pillars – nourish and nurture, people and enterprise, planet and resources, less waste.

'People and Enterprise' has six topics and 11 goals. Under the topic 'Productive, Profitable Growers' is the goal P.3 Responsible management of pests, weeds, diseases and agricultural inputs.

The indicators for this are:

- P.3.1 Industry capability to effectively manage pests, weeds and diseases
- P.3.2 Capability, understanding and adoption of integrated pest, disease and integrated weed management (IPDM and IWM) and resistance management strategies

A number of other indicators, notably those under 'Planet and Resources' around water and landscapes, are related to the practices of IPM (e.g. crop nutrition, biodiversity, biosecurity, etc.).

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THE PATH TO IPM PRACTICE LEGISLATION IN THE EU

In the European Union countries, there has been a slightly different approach to just legislating for restriction of inputs. In more of a carrot and stick approach, **farmers are legally required to practise IPM** (carrot, sort of) **and have had their access to chemicals severely restricted** (stick). In the EU's love of acronyms the chemicals are termed PPP or 'plant protection products'.

In 2009, the European Commission issued a Directive (Directive 2009/128/EC) establishing **a framework to achieve the sustainable use of pesticides** (SUD) with the aim of minimising the impact of pesticides on human health and the environment through:

- **reduced dependency**,
- the **increased use of low risk and non-synthetic chemical pesticides**, and
- **alternative approaches or techniques**, such as non-synthetic chemical alternatives to pesticides.

The Directive included a range of targets and actions to achieve this aim. **The influence of agricultural chemicals on biodiversity loss was a key driver for the Directive.**

Many of the actions taken by EU Member States under the Directive are also relevant to the Biodiversity Strategy and the Farm to Fork Strategy, which includes the adoption of pesticide reduction targets.

The main actions relate to training of users, advisors and distributors of pesticides, inspection of pesticide application equipment, the prohibition of aerial spraying, limitation of pesticide use in sensitive areas, and information and awareness raising about pesticide risks. **EU countries must also promote Integrated Pest Management**, for which, general principles are laid down in Annex III to the Directive (see page 11 for the full text).

EU 'pesticides package'

"Health and environmental concerns about the risks posed by the use of pesticides have led the European Union to introduce a series of measures in 2009 commonly referred to as the 'pesticides package', consisting in four pieces of legislation related to pesticides use. Within this package, the Sustainable Use of Pesticides Directive (Directive 2009/128/EC) provides a framework for action to promote the adoption of low pesticide input pest management approaches, in particular Integrated Pest Management (IPM) (EU 2009)."

Lefevbre et al. (2014)

EU database of substances & their definitions

The EU database of active substances, safeners and synergists is available here . It includes products deemed 'basic substance' (48 products), 'low risk active substance' (30 products) or 'candidate for substitution' (91 products).

"An active substance is any chemical, plant extract, pheromone or micro-organism (including viruses), that has action against 'pests' and diseases or on plants, parts of plants or plant products. Before an active substance can be used within a plant protection product in the EU, it must be approved by the European Commission."

"Safeners - Substances or preparations which are added to a plant protection product to eliminate or reduce phytotoxic effects of the plant protection product on certain plants."

"Synergists - Substances or preparations which, while showing no or only weak activity ... can give enhanced activity to the active substance(s) in a plant protection product."

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HOW IS THE EU IPM IMPLEMENTATION GOING?

A 2020 report on how EU member states were going with achieving their national targets and implementation of the Directive included this statement:

> "One of its key elements is the implementation of Integrated Pest Management (IPM/ICP) and the promotion of alternative approaches or techniques, so as to reduce dependency on pesticides."

It went on to say that the Common Agricultural Policy included instruments (i.e. legislation) "to support implementation of IPM by users".

As of 2020, **while it is compulsory to practice IPM, it is not required that records be kept and enforcement of the legislation is weak**. It has been recommended that under the Common Agricultural Policy IPM compliance could be linked to the payments producers receive under the policy (see Figure 3 and text box at the bottom of this page), termed "cross-compliance". It has also been recommended that support for extension and organic farming schemes be financed through the policy. The timeframe to implement these recommended changes were set at two to three years.

The current status is that the risks posed by the use of plant protection products, and the effect of mandatory IPM/ICP introduction can not currently be quantified as the data collected is insufficient to allow effective monitoring. However, **the European Commission has embarked on a comprehensive review of the Sustainable Use of Pesticides Directive which is to be completed by the end of 2021**.

Common Agricultural Policy (CAP)

"CAP was created by the Treaty of Rome (1957) to ensure food supplies for Europe, and provide a fair income for European farmers. The creation of CAP was central to the formation of the European common market, and an early step on the road to European integration."

https://www.economicsonline.co.uk/Global_economics/Common_Agricultural_Policy.html#The_Case_of_Sugar.

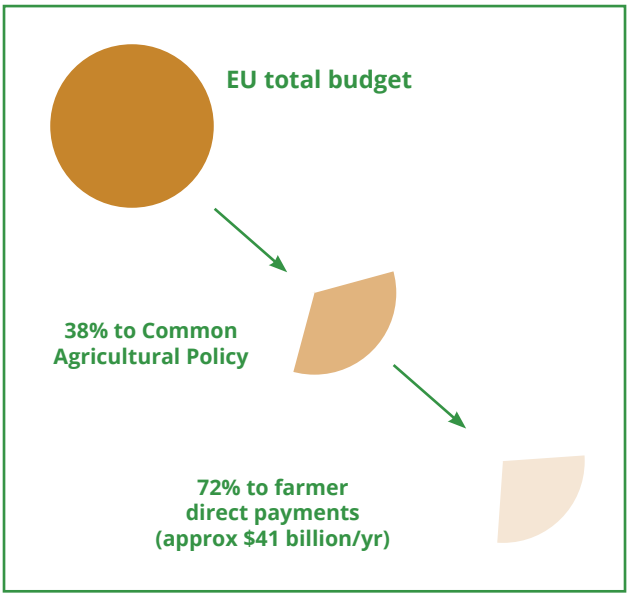

Figure 3. Breakdown of total EU budget

There are additional payments available to producers, amongst these is the Green Payment. Its aim is to support sustainable agriculture and remunerate farmers for protecting the environment and biodiversity as market prices may not reflect this.

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OVERALL EU CONTEXT – REDUCING ENVIRONMENTAL IMPACTS

EU Green Deal

One of the six European Commission priorities for 2019 – 2024 is a European Green Deal – **"Europe aims to be the first climate-neutral continent by becoming a modern, resource-efficient economy"** by 2050 and to '[transform] the EU's economy for a sustainable future'.

The very first paragraph of the Green Deal document gives this background:

> "This Communication sets out a European Green Deal for the European Union (EU) and its citizens. It resets the Commission's commitment to **tackling climate and environmental-related challenges that is this generation's defining task**. The atmosphere is warming and the climate is changing with each passing year. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are being polluted and destroyed."

Elsewhere the European Commision states:

> "To overcome these challenges, the European Green Deal will transform the EU into a modern, resource-efficient and competitive economy, ensuring:
>
> - **no net emissions of greenhouse gases by 2050** [i.e. 'climate neutrality']
> - **economic growth decoupled from resource use**
> - **no person and no place left behind**."

Policy areas affected by EU Green Deal

In order to tackle such broad scale issues the policy areas affected include:

- **biodiversity**
- **from farm to fork** ('ways to ensure more sustainable food systems')
- **sustainable agriculture** ('sustainability in EU agriculture and rural areas thanks to the common agricultural policy [CAP]')
- **clean energy**
- **sustainable industry**
- **building and renovating**
- **sustainable mobility (e.g. transport)**
- **eliminating pollution**
- **climate action.**

Figure 4. Policy areas affected by EU Green Deal

Or to put it more succintly...

"**The European Green Deal provides an action plan to**

- **boost the efficient use of resources by moving to a clean, circular economy**
- **restore biodiversity and cut pollution**"

In June 2021, **the 2050 climate neutrality objective was adopted into EU legislation, the 'European Climate Law'. The aim of the law is to set binding targets**. Now that this in place, relevant policy instruments can be developed to work towards those targets.

Given that biversity, 'Farm to Fork' and 'sustainable agriculture' are two of the policy areas of the EU Green Deal (see Figure 4), it can safely be assumed that there will be flow-on effects to agricultural production processes.

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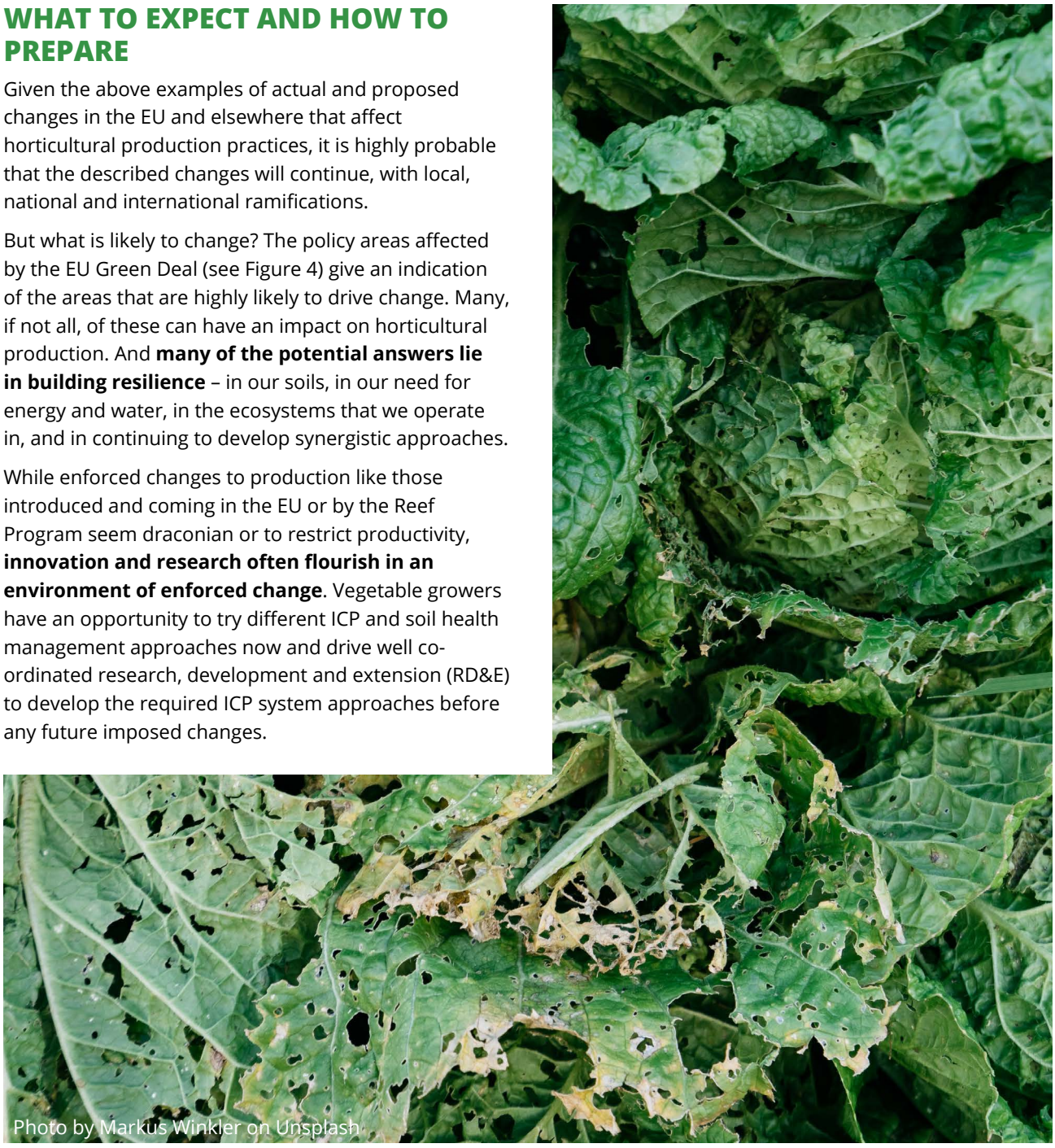
WHAT TO EXPECT AND HOW TO PREPARE

Given the above examples of actual and proposed changes in the EU and elsewhere that affect horticultural production practices, it is highly probable that the described changes will continue, with local, national and international ramifications.

But what is likely to change? The policy areas affected by the EU Green Deal (see Figure 4) give an indication of the areas that are highly likely to drive change. Many, if not all, of these can have an impact on horticultural production. And **many of the potential answers lie in building resilience** – in our soils, in our need for energy and water, in the ecosystems that we operate in, and in continuing to develop synergistic approaches.

While enforced changes to production like those introduced and coming in the EU or by the Reef Program seem draconian or to restrict productivity, **innovation and research often flourish in an environment of enforced change**. Vegetable growers have an opportunity to try different ICP and soil health management approaches now and drive well co-ordinated research, development and extension (RD&E) to develop the required ICP system approaches before any future imposed changes.



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ANNEX III (OF EUROPEAN COMMISSION DIRECTIVE 2009/128/EC)

General principles of integrated pest management

1. The prevention and/or suppression of harmful organisms should be achieved or supported among other options especially by:
   - crop rotation,
   - use of adequate cultivation techniques (e.g. stale seedbed technique, sowing dates and densities, under-sowing, conservation tillage, pruning and direct sowing),
   - use, where appropriate, of resistant/tolerant cultivars and standard/certified seed and planting material,
   - use of balanced fertilisation, liming and irrigation/drainage practices,
   - preventing the spreading of harmful organisms by hygiene measures (e.g. by regular cleansing of machinery and equipment),
   - protection and enhancement of important beneficial organisms, e.g. by adequate plant protection measures or the utilisation of ecological infrastructures inside and outside production sites.
2. Harmful organisms must be monitored by adequate methods and tools, where available. Such adequate tools should include observations in the field as well as scientifically sound warning, forecasting and early diagnosis systems, where feasible, as well as the use of advice from professionally qualified advisors.
3. Based on the results of the monitoring the professional user has to decide whether and when to apply plant protection measures. Robust and scientifically sound threshold values are essential components for decision making. For harmful organisms threshold levels defined for the region, specific areas, crops and particular climatic conditions must be taken into account before treatments, where feasible.
4. Sustainable biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control.
5. The pesticides applied shall be as specific as possible for the target and shall have the least side effects on human health, non-target organisms and the environment.
6. The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary, e.g. by reduced doses, reduced application frequency or partial applications, considering that the level of risk in vegetation is acceptable and they do not increase the risk for development of resistance in populations of harmful organisms.
7. Where the risk of resistance against a plant protection measure is known and where the level of harmful organisms requires repeated application of pesticides to the crops, available anti-resistance strategies should be applied to maintain the effectiveness of the products. This may include the use of multiple pesticides with different modes of action.
8. Based on the records on the use of pesticides and on the monitoring of harmful organisms the professional user should check the success of the applied plant protection measures.

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