

Climate Change: Managing Variability and Carbon



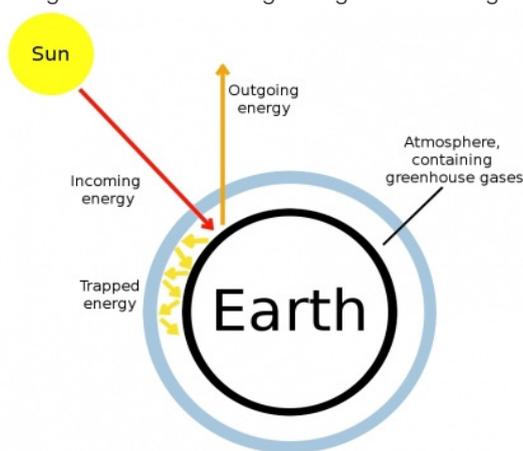
What is the greenhouse effect?

Energy from the sun passes through the atmosphere to the earth's surface. Some of this energy is absorbed and converted to heat, but most is re-radiated back towards space.

Greenhouse gases that occur naturally in the atmosphere allow incoming energy (radiation) from the sun to pass through and hit the earth's surface. However some of the outgoing radiation is absorbed and re-radiated back towards the earth's surface. This mechanism, called the greenhouse effect, warms the surface of the earth and maintains it at a temperature suitable for life.

How does it cause the climate to change?

The greenhouse effect is a natural process. However, human actions are leading to increasing levels of greenhouse gases in the atmosphere and causing an enhanced greenhouse effect that is contributing to a warming of the earth's surface and long-term climate change or "global warming."



The three major greenhouse gases produced by human activities are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Agricultural activities that produce greenhouse gases include fertiliser application, soil carbon losses through tillage and fallowing, on-farm energy use, and livestock emissions.

Key terms:

Carbon sequestration is the storage of carbon that would otherwise be released into the atmosphere.

Climate mitigation involves reducing the sources of greenhouse gases and creating or enhancing carbon sinks.

Climate adaptation refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Carbon footprinting is a measure of how much greenhouse gas emissions specific human activities release.

Key Messages

- Vegetable producers can be affected by 'climate change' in two ways:
 1. Due to the effects of increasing temperatures and carbon dioxide levels, as well as changes that precipitation and wind have on the production environment.
 2. Due to government policies aimed at reducing carbon emissions and rewarding carbon sequestration.
- Climate modeling has indicated that many of the impacts of climate change may be reduced, delayed or avoided by reducing greenhouse gas emissions.
- Although horticulture accounts for only 1% of Australia's total greenhouse gas emissions, it tends to have greater emissions intensity per hectare of land than other agricultural production enterprises.
- Carbon footprinting is a measure of the greenhouse gas emissions produced by a particular product or activity. The vegetable industry needs to understand its carbon footprint so that emissions can be accounted for, reported and managed.
- It is important for vegetable growers to reduce the sources of greenhouse gases and create or enhance carbon sinks to reduce their input costs and environmental impact.



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The contribution of horticulture to climate change

The Australian agricultural industry as a whole accounts for 16-18% of greenhouse emissions, but horticulture contributes only 1% to this total. This small contribution is primarily due to the smaller area of land use.

Despite its small environmental impact, horticulture (and vegetable production in particular) tends to have a greater impact per hectare because of the intensity of production, infrastructure requirements (including cooling facilities) and relatively high fertiliser use.

Sources of greenhouse gases from horticulture come from:

- Fuel and electricity use (70%) especially for irrigation.
- Nitrogen fertilisers and animal manures (20%).
- Waste and refrigerant loss to the atmosphere (10%).

There are opportunities to reduce the emissions from horticulture, gaining the additional advantages of reduced input costs and environmental impact.

The impact of climate change on horticulture

Climate change as a consequence of the enhanced greenhouse effect will have both positive and negative impacts on horticulture. According to international scientific evidence, the most likely changes in our climate will be an increase in temperature of up to 2 °C over the next 50-100 years and more variable rainfall events. The warming of the atmosphere may also influence precipitation intensity, types and patterns, wind directions and intensity, and the frequency and severity of extreme weather events. This will mean increased risk for growers and changes in the way crops are grown.

GREENHOUSE GAS	NATURAL PROCESSES THAT PRODUCE THE GAS	ACTIVITIES THAT PRODUCE THE GAS (ACTIVITIES OF RELEVANCE TO VEGETABLE GROWERS IN BOLD)	MANAGEMENT TECHNIQUES FOR VEGETABLE GROWERS
Carbon dioxide (CO ₂)	<ul style="list-style-type: none"> • Respiration by living organisms • Forest fires • Evaporation from seawater 	<ul style="list-style-type: none"> • Combustion of fossil fuels (coal, oil and gas) such as electricity generation and transport • Land clearing • Loss of soil carbon 	<ul style="list-style-type: none"> • Improve fuel and energy efficiency • Grow native vegetation • Use minimum till techniques and controlled traffic technologies
Methane (CH ₄)	<ul style="list-style-type: none"> • Decomposition of organic matter • Methane-producing bacteria 	<ul style="list-style-type: none"> • Livestock farming (livestock emissions and decomposition of animal wastes) • Extraction of fossil fuels • Wet rice cultivation • Burning of crop residues and savannah • Landfill • Domestic sewage • Coal mining 	
Nitrous oxide (N ₂ O)	<ul style="list-style-type: none"> • Microbial action 	<ul style="list-style-type: none"> • Application of fertiliser and animal waste to agricultural soil • Burning of crop residues and biomass • Manure management • Transport 	<ul style="list-style-type: none"> • Improve fertiliser management and nitrogen use efficiency • Incorporate biochar and organic matter into soil • Improve fuel efficiency
Hydrofluorocarbon (HFC)	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Cooling 	<ul style="list-style-type: none"> • Improve energy efficiency

Key Message

Changes in government policies, aimed at reduction of predicted climate change effects and consumer preferences, will have an impact on how agriculture businesses operate.



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Farming to reduce your vulnerability to climate change: adaptation

The physical impacts of climate change on the horticultural industry pose both opportunities and threats for horticulture. Potential changes that may be observed are:

- Suitability of the region for cropping.
- Increased crop productivity due to higher atmospheric carbon.
- Length of growing season and plant growth rates.
- Greater risk of physiological disorders, incursions of new pests and spread of soil-borne diseases.
- Distribution of pests and diseases.

There is a need for growers to adapt their practices to reduce the impacts of unavoidable climate change, and climate variability, and take advantage of potential opportunities. These opportunities may include:

- Using different varieties.
- Changing the timing of production.
- Modifying irrigation, pest and soil management.

Many research projects are currently being undertaken to help horticultural growers respond to climate change. Details of these projects can be found on the HAL website at http://www.horticulture.com.au/areas_of_investment/Environment/Climate/climate_home.asp?src=side or at the Climate Change Research Strategy for Primary Industries website at <http://ccrspi.org.au/>

Farming to reduce your impact on climate change: mitigation

Mitigation involves reducing the sources of greenhouse gases and creating or enhancing carbon sinks.

On-farm mitigation options relate to improving the efficiency of input use and the use of best management practices that promote the goals of reduced emissions, increased productivity and sustainability.

Examples of on-farm mitigation techniques include:

- Improved fuel and energy efficiency.
- Improved fertiliser management and nitrogen use efficiency.
- Improved irrigation management and water use efficiency.
- Minimum tillage and reduction of fallow periods.
- Using less packaging, or packaging made from recycled/recyclable materials.

Growers are also creating carbon sinks to offset emissions (also known as carbon sequestration) by:

- Better soil management e.g. controlled traffic technologies.
- Increasing soil carbon.
- Growing native vegetation.
- Incorporating biochar and organic matter into soil.

Planting trees, improving the energy efficiency of the farm and changing soil management practices are the three most common methods used by growers to reduce their carbon footprint and mitigate climate change.

Impacts on Marketing

The other main challenge for horticulture, aside from the physical impacts described above, is the need to respond to changes in consumer preferences and government policies. Greater environmental awareness means that consumer purchases are increasingly being influenced by 'green' preferences. In addition, policy changes such as emissions trading schemes or labeling requirements may place mandatory reporting and compliance requirements on growers.

These changing consumer preferences and government policies mean that in future growers will not only have to adapt to the changing climate; they will also be required to account for and reduce their contribution to climate change. Many of the impacts of climate change can be reduced, delayed or avoided by reducing greenhouse gas emissions.

Market pressure for carbon labeling

- Supermarket giants Tesco in the UK and Wal-Mart in the US already use voluntary carbon-labeling schemes
- In 2012 the European Union will require all products to carry eco-labels and in 2011 France is undertaking a year-long trial with carbon footprint labeling



- Planet Ark has recently launched the voluntary Carbon Reduction Label in Australia and New Zealand. Three products have already earned this label: ALDI's everyday olive oil, the Dyson Airblade hand dryer range and the New Zealand Wine Company's Mobius Marlborough Sauvignon Blanc.



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Carbon Footprinting

A carbon footprint is a measure of the greenhouse gas emissions produced by a particular product or activity. Carbon footprinting is a method of carbon accounting.

The carbon footprint of a vegetable farm would account for all on-farm emissions of carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and hydrofluorocarbon. That is, all emissions occurring within the farm boundary from activities such as energy and fertiliser use.

The Vegetable Carbon Calculator

The Vegetable Carbon Calculator is a carbon footprinting tool specifically designed for the Australian vegetable industry. It is accessible online at www.vegiecarbontool.com.au

The Vegetable Carbon Calculator helps growers estimate the carbon footprint of their farm by identifying emissions associated with fertiliser use, electricity, fuel, waste, refrigerants and land use change. Growers can calculate a whole farm footprint, or allocate the total footprint to specific crops grown on the farm to see how each emission component contributes to the whole farm footprint overall.

How to use carbon footprinting as a business tool

The horticultural industry needs to understand its carbon footprint so that emissions can be accounted for, reported and reduced.

The primary reason for measuring carbon footprints is to report or account for the level of greenhouse gas emissions to a third party. At present (February 2011) there is no requirement for vegetable growers to undertake carbon accounting on their farms or to comply with carbon labeling requirements. However, as noted previously, consumer preferences and government policy may create the need for carbon accounting and reporting by growers.

Tools such as the Vegetable Carbon Calculator are designed to help growers understand their carbon footprint in order to reduce emissions, improve on-farm efficiencies and increase their sustainability.

Reducing greenhouse gas emissions can both lessen the

impacts of climate change and improve on-farm efficiencies by lowering input costs associated with fuel, electricity and nitrogen fertilisers. It may also lead to an improvement in overall soil and crop health and productivity.

Case Study: The Loose Leaf Lettuce Company

Maureen and Barry Dobra own and operate The Loose Leaf Lettuce Company in Gingin WA. They have been growing vegetables for almost 40 years.

Maureen and Barry were part of a group of pioneering growers who adopted the AUSVEG 'EnviroVeg' Program in its early stages. EnviroVeg is the vegetable industry's own environmental program developed specifically for vegetable growers.

The couple joined the program because the philosophies of EnviroVeg – a sustainable approach to farming and environmental stewardship – aligned closely with their business values. Consumer attitudes were also a driver of their decision to join the program, as they felt that consumers were becoming more aware of environmental issues.

As a result of joining the program Maureen and Barry have implemented a number of changes on their farm, including:

- Improved water use efficiency – through changing the sprinkler system to one with a more uniform spray to control over-irrigation, waterlogging and nutrient leaching.
- Utilising an agronomist to manage fertiliser decisions.
- Farm planning on their second farm to incorporate native vegetation, gravel roads and better fencelines.

According to Maureen and Barry, the main benefit of the EnviroVeg program is increasing productivity and profitability while decreasing the environmental impact of farming.

Improving input use efficiency and incorporating best practice management techniques such as that described above will also assist in reducing greenhouse gas emissions and therefore minimise your carbon footprint.

For more information on this case study refer to the September/October 2010 issue of Vegetables Australia magazine, available at <http://www.ausveg.com.au>

For further information

- For information on the EnviroVeg program visit www.ausveg.com.au/enviroveg/programs.htm.
- For further information on this fact sheet or on managing climate change and carbon footprinting please contact Kristen Stirling from the InnoVeg Program on 03 9882 2670 or your state vegetable association.
- To search for resources to assist you with managing climate change go to the R+D Insights Database (located in the log-in section of the AUSVEG website).



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