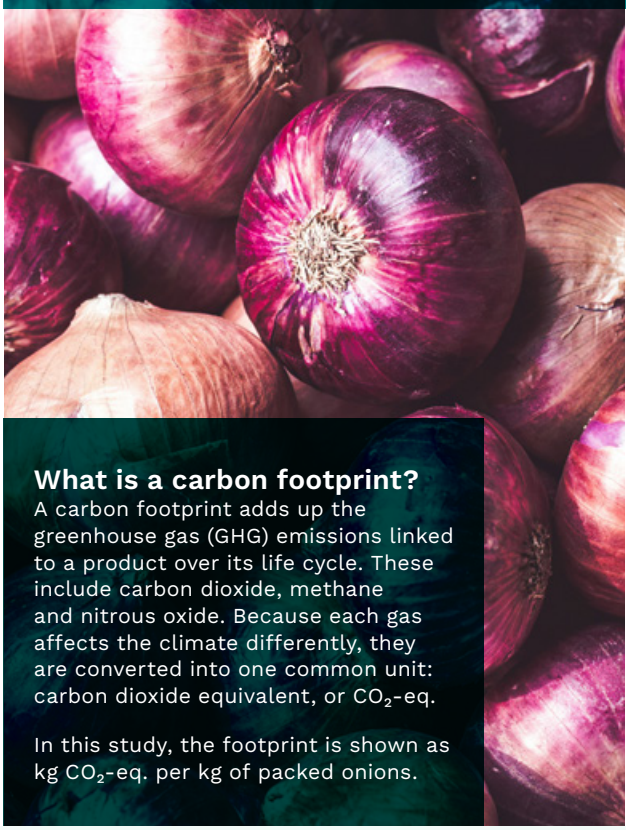
Carbon footprint of Australian onions

This is a summary of a wider LCA study. You can find project details at Hort Innovation.

Our study follows the best-practice-based ISO 14040 and ISO 14044 standards for Life Cycle Assessment.



Australian onions are one of the country's largest vegetable crops by volume, with growers producing more than 250,000 tonnes each year, valued at $307 million (FY 2024/25).

As consumers, retailers and other supply chain partners pay increasing attention to the environmental impacts of onion production, Hort Innovation commissioned this study to help the Australian onion industry understand the carbon footprint of growing, packing and preparing onions for market.

A carbon footprint is one way to measure environmental impact. It shows where emissions come from and can help identify where fuel, fertiliser, electricity, packaging and other inputs could be used more efficiently.

The results give growers a starting point to track progress, improve efficiency and reduce emissions over time, as Australia works towards net-zero emissions by 2050.

What is a carbon footprint?
A carbon footprint adds up the greenhouse gas (GHG) emissions linked to a product over its life cycle. These include carbon dioxide, methane and nitrous oxide. Because each gas affects the climate differently, they are converted into one common unit: carbon dioxide equivalent, or CO_2-eq.

In this study, the footprint is shown as kg CO_2-eq. per kg of packed onions.

Our study at a glance

What we studied
Carbon footprint of Australian onions, including their packaging.

Who provided data
Five onion growers across three states.

How growers were engaged
RMCG supported grower engagement and data collection, including outreach to growers, on-farm visits and follow-up conversations to help collect reliable data.

How much production this covered
8,461 tonnes of onions.

Data years
2023 and 2024 production years.

What it is for
To show where the carbon footprint comes from across onion growing, packing and key inputs, and help growers identify practical ways to reduce it and improve input efficiency.

What it is not for
Public claims comparing the carbon footprint from Australian onions with other countries, products, growers or industries.

The onion life cycle

This study used life cycle assessment (LCA) to look at onion production from cradle-to-farm gate. That means it covers the production steps and associated inputs up to the packed onions leaving the farm or packing facility. It did not include distribution and retail storage and how onions are stored, cooked or onion waste is disposed of by consumers.

What is an LCA?

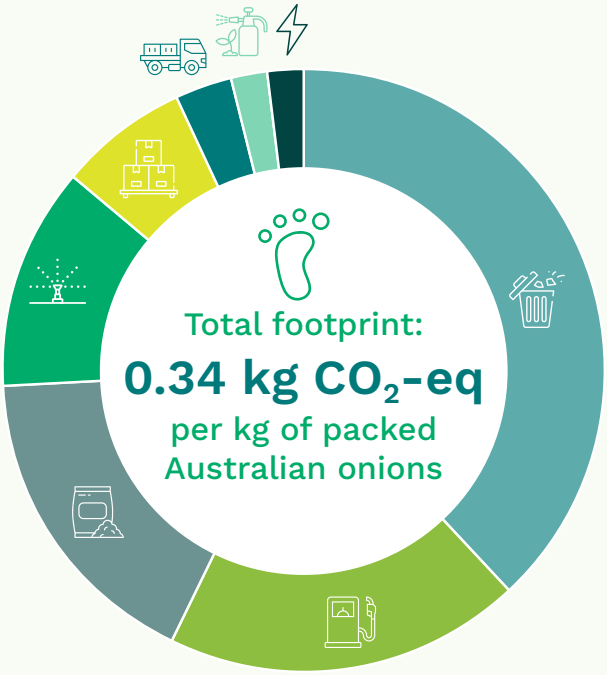
A life cycle assessment, or LCA, is a tool that measures the environmental impact of a product over its life cycle and value chain.

An LCA can look at many impacts, including water use and resource use. This summary focuses on the carbon footprint.

Carbon footprint of Australian onions

This is the cradle-to-gate carbon footprint of Australian farmed onions in this study.

Where the footprint comes from:



38% Rejected onions
Non-sellable onions left on farm release emissions as they break down.

19% Fuel used on farm
Fuel used for tractors, irrigation pumps and other machinery.

17% Making fertilisers and soil amendments
Emissions from producing inputs such as fertilisers and lime.

12% Using fertilisers and soil amendments
Emissions released when these inputs are applied on farm.

7% Packaging
Packaging for finished onions, especially plastic net packaging.

3% Transport
Emissions from moving inputs and onions.

2% Agrichemicals
Emissions from producing agrichemicals used on farm.

2% Electricity
Electricity used on farm and during packing or storage.

BENCHMARK FOOTPRINT

0.34 → **0.56**

kg CO_2-eq./kg kg CO_2-eq./kg

ADDED IMPACT OF TRANSPORT

What difference does transport make:

The carbon footprint reported in this summary stops at the farm gate. It includes growing, packing and preparing onions for market, up to the point where packed onions leave the farm or packing facility.

The study also looked at what happens if the impact of transport to retailers is added. Using an average transport scenario across Australia, the footprint could increase from 0.34 to 0.56 kg CO_2-eq. per kg of packed onions.

What growers can do to reduce emissions

There is no single fix. The biggest gains are likely to come from a mix of practical actions that improve saleable yield, reduce waste, use inputs such as nitrogen fertilisers, water and chemicals efficiently and avoid shifting GHG impacts from one part of the onion life cycle to another. Using resources more efficiently can also support productivity and profitability while reducing emissions.

This study gives the Australian onion industry a practical starting point. The next step is to use these findings: focus on the biggest hotspots, test what works on your farm and in the packing shed, and keep collecting data to track progress over time.

Five focus areas for growers

1. Improve saleable yield

Good soil, crop nutrition, pest and disease management and irrigation can help increase the share of onions that are sold.

2. Find better uses for rejected onions

Where suitable, avoid leaving rejected onions on farm or going to landfill. Options such as animal feed may reduce impacts.

3. Use less fossil fuel

Use energy more efficiently and reduce reliance on diesel, LPG and petrol where practical. Also look at improving irrigation pump efficiency.

4. Optimise fertiliser use

Optimise fertiliser use by building or maintaining soil organic matter, reducing fallow periods and tillage where practical, using cover crops, and applying fertiliser at the right rate, time and place. Split applications and enhanced efficiency fertilisers, such as coated urea or slow-release products, may also help where suitable.

5. Take a whole-of-life view

Before making changes, check the whole picture. A change that reduces emissions in one area should not increase emissions or costs somewhere else in the onion life cycle.

How to improve future carbon footprint assessments and LCAs

Onion growers can support future carbon footprint assessments, LCAs and emissions data requests by collecting 12 consecutive months of data. It helps to record the quantities of inputs used, not just what they cost. For example, record electricity in kilowatt hours, fuel in litres, fertiliser in kilograms and water in litres or megalitres.

Where possible, attach invoices and other documents to financial records.

It also helps to record the amount of fertiliser and chemicals applied, including active ingredients where available. Keeping categories consistent year to year makes it easier to compare results and track progress over time.

What to record

Raw materials	Energy	Water	Packaging	Waste
Type and mass (kg) or volume (litre)	Electricity (kWh) and fuels (litre)	Municipal, surface and groundwater, recycled water (litre)	Material type and mass (kg)	Reject onions and waste mass (kg) by type and treatment / disposal method

Four modelled examples for growers

The following case studies show what could happen if growers changed one or more areas identified in the study. They are modelled examples, not real farm stories. The growers are fictional, and the results are not based on one specific farm.

Case study 1:

Finding a better use for rejected onions

When rejected onions were collected and used as animal feed, the carbon footprint fell by 25%.

The opportunity

After harvest, onion grower Steve looks at the pile of onions that did not make the grade. They are too small, damaged or misshapen to sell. He knows rejected onions left on farm are one of the biggest contributors to the carbon footprint. As they break down, they release emissions – largely methane, a powerful greenhouse gas. Steve asks: *Could these onions be useful somewhere else?*

What changed on the farm

Instead of leaving rejected onions on farm, Steve collects them and sends them to a third-party facility where they are used as animal feed. This keeps the onions in use and avoids some of the emissions linked to waste treatment on farm.

What we assumed

We modelled a scenario where:

- all rejected onions are collected
- they are transported by road to a third-party facility
- they are used as animal feed
- the transport distance is 100 kilometres
- everything else on farm stays the same.

The study describes the 100 kilometre transport distance as a conservative assumption. It does not include what happens after the rejected onions arrive at the third-party facility.

Impact at a glance

BENCHMARK FOOTPRINT		REJECTED ONIONS TO ANIMAL FEED
0.34 kg CO_2-eq./kg	→	0.26 kg CO_2-eq./kg

25% lower carbon footprint per kg of packed onions

What that means for onion growers

Rejected onions are not just a waste issue. They can be a carbon hotspot. Finding a practical use for them, such as animal feed, could help reduce the footprint. The best option will depend on what is available nearby, how far the onions need to travel and whether the solution works commercially.

Case study 2:

Lifting saleable yield

When more onions made it into the saleable crop, the carbon footprint fell by 40%.

The opportunity

After harvest, Tom looks across his bins and notices a familiar pattern. The crop was there, but too many onions did not make the grade. Some were too small. Some had quality issues. Some were damaged during harvest or handling. Tom asks: *What would happen if more of the crop became saleable product?*

What changed on the farm

In this scenario, Tom improves the share of onions that can be sold. That could come from better soil management, crop nutrition, irrigation, pest and disease control, harvesting, curing or storage. More onions make it into packed product. Fewer onions become rejects.

What we assumed

The study modelled a scenario where:

- saleable yield increases by 20%
- rejected onions decrease by the same amount
- all other inputs and processes stay the same.

With this change, the carbon footprint fell from 0.34 to 0.21 kg CO_2-eq. per kg of packed onions. That is a 40% reduction.

What that means for onion growers

Improving saleable yield can be one of the strongest ways to reduce the footprint per kilogram of packed onions. This is because the same farm effort creates more saleable product and less waste. In other words: more of what you grow ends up being sold.

The best approach will differ from farm to farm, but the direction is clear. Actions that improve crop quality and reduce rejects can have a big impact.

Case study 3:

Using fertiliser more efficiently

When fertiliser use was reduced by 10%, the modelled carbon footprint fell by 3% – but only if yield level was protected.

The opportunity

Onion grower Sarah is reviewing her input costs for the season. Fertiliser is one of the bigger line items, and she knows it also contributes to the carbon footprint of her onions.

But she also knows cutting fertiliser too far could affect yield, quality and profit. So the question is not simply: *Can I use less?* It is: *Can I use fertiliser more efficiently without reducing the crop I sell?*

What changed on the farm

In this scenario, Sarah reduces fertiliser use across the farm.

The carbon footprint improves because there are fewer emissions linked to making fertiliser and fewer emissions from fertiliser use on the farm.

What we assumed

The study modelled a scenario where:

- fertiliser use decreases by 10%
- all other inputs and processes stay the same
- yield does not change.

With this change, the carbon footprint fell from 0.34 to 0.33 kg CO_2-eq. per kg of packed onions. That is a 3% reduction.

Impact at a glance

BENCHMARK FOOTPRINT		10% LESS FERTILISER
0.34 kg CO_2-eq./kg	→	0.33 kg CO_2-eq./kg

3% lower carbon footprint per kg of packed onions

What that means for onion growers

Using fertiliser more efficiently can help, but it is unlikely to deliver the biggest reductions on its own.

The practical opportunity is to use fertiliser well: apply the right product, the right amount, at the right time, in the right place[1]. This could include soil testing, split applications, improving soil organic matter, using cover crops and considering enhanced efficiency fertilisers where suitable.

The key is to avoid reducing fertiliser in a way that reduces saleable yield. If yield drops, the footprint per kilogram of packed onions could go up.

[1] 4R Nutrient Stewardship (The Fertiliser Institute)

Case study 4:

Stacking the gains

When three practical changes were combined, the carbon footprint fell by 48%.

The opportunity

After looking at the numbers of this study, Jun realises there is no single fix. Rejected onions matter. Saleable yield matters. Fertiliser use matters too.

Instead of focusing on one change, Jun asks: *What if we improved several things at once?*

What changed on the farm

In this scenario, Jun works on three areas:

- more onions make it into the saleable crop
- fewer rejected onions are left on farm
- fertiliser is used more efficiently.

Together, these changes reduce waste, spread the farm's inputs across more saleable onions and lower fertiliser-related emissions.

What we assumed

The study modelled a scenario where:

- fertiliser use decreases by 10%
- saleable yield increases by 20%
- all rejected onions are collected and used as animal feed
- all other inputs and processes stay the same.

With these changes, the carbon footprint fell from 0.34 to 0.18 kg CO_2-eq. per kg of packed onions. That is a 48% reduction.

What that means for onion growers

The biggest gains are likely to come from combining practical changes. For growers, this means focusing on the hotspots together: improve crop quality, reduce rejects, find a better use for rejected onions and use fertiliser well.

In practice, the right mix will depend on the farm, the season, the market and what options are available nearby.

RMCG

For this project, RMCG supported grower engagement and data collection. This included helping connect with growers, supporting on-farm visits and working with thinkstep-anz to follow up on data questions. RMCG is a multi-disciplinary consultancy specialising in environment, agriculture and communities. They provide policy advice to primary producers, government agencies, water authorities, institutions and private sector clients in the fields of environment, water, agriculture, economics and communities.

www.rmcg.com.au

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thinkstep anz

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