

Food Circle

Supporting Ireland's National Food Waste Prevention Roadmap



Rialtas na hÉireann
Government of Ireland



REPORT 5

FARM LEVEL LOSS IN IRELAND: CAUSES AND SOLUTIONS

for the Department of Climate, Energy and the Environment

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Executive Summary

This report, 'Farm-level food loss in Ireland: causes and solutions', is the fifth in a series from the Food Circle project, a research and engagement initiative led by FoodCloud and funded by the Department of Climate, Energy and the Environment. This report focuses on priority action #21 of the National Food Waste Prevention Roadmap (2023-2025), to 'work with key sectors (e.g. primary production and retail sectors) to examine how food waste due to product specification related aspects (e.g. misshapen fruit and vegetables) can be avoided.' This action sits within the food donation section of the Roadmap, and this report focuses mainly on the role of food donation as a solution for horticultural surplus, within the broader context of food loss and waste prevention.

Only 1% of the 133,000 farms in Ireland are involved in fruit and vegetable production. The National Strategy for Horticulture 2023-2027 highlights that the sector is facing a number of challenges and these challenges are leading to growers leaving the sector. Recent estimates suggest there are just 74 commercial field vegetable growers left in Ireland, with production focused in the south and east of the country.

A 2022 study by Attard and O'Connor for the Environmental Protection Agency found that vegetable production accounts for the main source of food loss and waste (FLW) at farm-level in Ireland with approximately 122,000 tonnes per annum lost or wasted before the farm gate. Approximately 78% of this (94,877 tonnes) is described as having been suitable for consumption (edible) but unsaleable due to market fluctuations or specifications, harvesting or storage challenges (Appendix 10, Table 1). If all the edible FLW were used rather than going to waste, there is a potential increase in domestic horticulture production of 15.8% (Appendix 10, Table 2).

A separate 2022 study found that 70% of farmers had surplus produce. This second study, also by Attard and O'Connor, found that FLW in horticulture is generally caused by one of the following factors: (i) retail product specifications (size, colour, shape, blemishes); (ii) market/customer demand fluctuations; (iii) environmental factors (weather, pests); and/or (iv) lack of a secondary market or widespread processing market for all vegetables.

In line with the food use and waste hierarchy, growers, businesses and policy makers should first work to prevent food surplus from arising. Where it cannot be prevented at source, they should seek to prevent FLW through secondary markets or valorised products. These options maximise the use of edible surplus by finding an alternative route to sale, giving it an extended shelf life, or serving it in a way that is more accessible for the consumer. Innovations in this space can be introduced that have broader benefits for food systems and social benefits. Where safe, edible surplus

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remains, stakeholders should look to food donation. This is FLW prevention through redistribution of surplus for human consumption. It should be prioritised ahead of lower-value outlets such as animal feed, industrial uses (rendering or biorefining), anaerobic digestion, composting, or disposal.

Agricultural recovery is the collection and redistribution of safe, edible surplus crops from farms and fields to community groups to feed people who need it. It can include: (i) unpaid donation; (ii) gleaning (where volunteers collect surplus produce that has not been harvested); or (iii) compensated recovery (where the grower is partially compensated for the cost of donating the food). Agricultural recovery keeps farm-level surplus from going to waste, supports access to nutritious food for vulnerable communities, and reduces the environmental impact of food production. When recovery is compensated, it also supports farm viability and food security.

With funding from the Department of Agriculture, Food and the Marine (DAFM, through the Rural Innovation and Development Fund) and philanthropic sources, FoodCloud has piloted different operational models of agricultural recovery over the last four years. Through its Growers' Project, FoodCloud initially supplied its own network on a small scale, increasing from 2023 to work with Local Development Companies and larger community partners to redistribute larger quantities of vegetables and to access rural communities that it was not previously able to access (particularly the counties of Donegal, Kerry and northwest Cork). Since piloting the project in 2021 to December 2025, FoodCloud has redistributed nearly 700 tonnes of farm-level surplus from 9 growers to 237 community groups, delivering over 1.6 million meals equivalent.

Scaling this project, a national, compensated agricultural recovery programme could redirect 5,000 tonnes of Ireland's farm-level horticultural surplus annually by 2030 to people who need it and save approximately 9,000 tonnes of carbon dioxide equivalent emissions from going to waste¹. This estimate is based on the available data on edible surplus, as well as knowledge and experience from the Growers' Project.

As well as directly addressing Action 21 of the Roadmap, this would contribute directly and significantly to the United Nations Sustainable Development Goal (UNSDG) 12.3 by 2030 to *'halve per capita global food waste at the retail and consumer levels and*

¹ Recovering 1kg of whole vegetables saves approximately 1.8kg of carbon dioxide equivalent emissions from going to waste, as calculated by FoodCloud's internal carbon calculator, which estimates FoodCloud's annual carbon balance in order to more accurately quantify the environmental benefits, in terms of GHG emissions, of surplus food redistribution. The balance is the result of the consideration of two elements: (1) the emissions generated by FoodCloud's activities; and (2) the emissions that are saved from going to waste by redistributing food that would otherwise be wasted. The life cycle assessment of emissions in the vegetables is currently derived from the AGRIBALYSE® Life Cycle Inventory database.

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reduce food losses along production and supply chains, including post-harvest losses'.

By capturing surplus at farm-level and moving it through community networks, agricultural recovery also contributes to UNSDG 2.1, *'end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round'*. It offers growers a reliable outlet and fair return for surplus and Grade II produce, contributing to UNSDG 2.3, *'doubling the agricultural productivity and incomes of small-scale food producers'*.

A national agricultural recovery programme will support the horticulture sector and deliver against the aim set out in the Programme for Government to strengthen farm incomes for family farms. Such a programme would also directly support Ireland's current health strategy, Healthy Ireland, through improved access to nutritious fruit and vegetables for people of all ages in disadvantaged communities. As a practical, cross-sector initiative, enabling government, growers, civil society and philanthropy to play their part in creating a healthier Ireland, it aligns with Healthy Ireland's Healthy Eating and Active Living programme and further supports implementation of the Nutrition Guidelines for Food Parcels. This is particularly important in light of the 2024 Healthy Ireland survey which highlighted that only 28% of the population reported eating five or more portions of fruit and vegetables each day, 6 points lower than reported in 2019².

The estimated cost of funding the programme, redistributing 5,000 tonnes of surplus annually by 2030, is approximately €3 million per year. The indicative annual cost is modest relative to the social, economic and environmental benefits set out in this report. Multi-annual funding would enable growers and food recipients, as well as delivery partners, to plan ahead, maximising efficiency and impact. In the short term, the most appropriate funding model for Ireland is multi-annual direct Government support. Ireland should explore the use of Producer Organisation market withdrawal funding, other relevant EU Common Agricultural Policy measures and other EU funding mechanisms as part of a wider long-term funding approach.

FoodCloud's Growers' Project has proven that compensated agricultural recovery has multiple social, economic and environmental benefits, including preventing farm-level food waste due to product specification related aspects, and has demonstrated exactly how this could be delivered. As Ireland moves towards 2030, there is an opportunity for the development of a medium term, national programme for agricultural recovery that will showcase Ireland's leadership in the circular economy

² Healthy Ireland Survey 2024, updated 20 October 2025. The Irish food pyramid promoting a healthy diet recommends 5-7 portions of fruit and vegetables a day.

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and sustainable farming, while protecting growers and food security, and addressing our UNSDG obligations and Action 21 of the Roadmap. This report therefore calls for the Government's support to implement a fully scaled national programme for agricultural recovery.

This report puts forward the following key recommendations:

A. Support for a national compensated agricultural recovery programme

A.1	Establish a medium term national compensated agricultural recovery programme, building on the Growers' Project, enabling redistribution of 5,000 tonnes of surplus each year by 2030, using the five-year impact and cost projections set out in this report.
A.2	Embed agricultural recovery and surplus prevention in successor strategies to the National Food Waste Prevention Roadmap, Healthy Ireland and the Roadmap for Social Inclusion, and in implementation of the National Strategy for Horticulture, so that farm-level surplus and redistribution are recognised as cross-cutting policy tools.
A.3	Provide multi-annual direct Government funding as the core short term funding mechanism for the programme, while also pursuing alternative options for EU funding.

B. Invest in and support food waste prevention in the order established in the Food Use and Waste Hierarchy

B.1	Invest in prevention at source by improving data on farm-level losses, supporting the use of structured tools such as the WWF Global Farm Loss Tool, progressing mandatory FLW reporting (while recognising any burden this places on growers), and promoting collaborative work on specifications, contracts, labour and logistics that will reduce surplus.
B.2	Support market-oriented waste prevention initiatives that keep surplus in the human food chain, particularly valorisation activities that create marketable and / or shelf-stable produce, promoting avenues to use these valorised products as part of socially or nutritionally beneficial

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	initiatives (such as for use in institutional settings such as school meals, hospitals, social supermarkets, Meals on Wheels and other types of community food sharing).
B.3	Prioritise prevention of food waste by redirecting food for human consumption ahead of lower-value outlets such as animal feed, industrial uses (rendering or biorefining), anaerobic digestion, composting, or disposal.

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1. Introduction

Background - the Food Circle Project

The Food Circle project is a two-year research project funded by the Department of Climate, Energy and the Environment examining in detail the priority actions from Ireland's National Food Waste Prevention Roadmap (2023-2025) (the Roadmap) relating to food donation and redistribution. Led by FoodCloud, it includes project partners Clean Technology Centre and food loss and waste (FLW) expert Kai Robertson. Through collaboration with food businesses, policymakers and community groups, the purpose of this project is to identify and promote best practice and potential policy interventions in food redistribution and food waste reduction that can reduce FLW in Ireland.

This report focuses on the Roadmap priority Action 21:

#21

Work with key sectors (e.g. primary production and retail sectors) to examine how food waste due to product specification related aspects (e.g., misshapen fruit and vegetables) can be avoided.

This report is the fifth in a series of reports for the Food Circle project, each addressing the food redistribution priorities referred to in the Roadmap. In particular, it can be read together with Report 1, which provides the wider policy context and detailed analysis of various policy levers.

Report	Topic
1	Policy levers for food redistribution
2	Supporting a voluntary target for surplus food donation
3	Building community sector capacity for surplus food redistribution
4	Supporting the infrastructure of food redistribution
5	Farm-level food loss in Ireland: causes and solutions (this report)

Structure and methodology

Section 1 introduces the Food Circle project and the range of reports being produced by this project. Section 2 outlines the policy context in which this report is being examined. Section 3 provides an overview of the volume and causes of agricultural surplus. Section 4 examines solutions for surplus, including prevention at source, secondary markets and valorisation, and donation and redistribution. Section 4 also

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outlines the barriers to unpaid donation and gleaning. Section 5 reviews FoodCloud's Growers' Project agricultural recovery programme, its benefits and the opportunities, while Section 6 describes the impact and cost of scaling up compensated agricultural recovery in Ireland, its potential impact and cost, and references possible models of funding. Section 7 provides recommendations and a conclusion.

2. Policy Context

FLW has relevance across environmental, health and social policies. A review of international and Irish policies is set out in this section.

Sustainable Development Goals

Ireland is committed to the United Nations Sustainable Development Goals (UNSDG). The aim of UNSDG 2 is to '*...end hunger, achieve food security and improve nutrition and promote sustainable agriculture*'. UNSDG 12.3 aims to '*halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses*'.

Food waste law and policy

The European Commission's Food Use and Waste Hierarchy³ (see figure 1) sets out the prioritisation of actions to manage and reduce FLW⁴. 'Prevention at source' is the priority. When food surplus is unavoidable, the hierarchy provides that food should be used in the most resource-efficient manner possible. Donation and redistribution of surplus food is included under the broad heading of prevention, while recycling, nutrient recovery (including production of biogas) and disposal are waste treatments; they are not counted as food waste prevention.

³European Commission Joint Research Centre 2024.

⁴ Edible surplus produce may be classed as food 'loss' or food 'waste', depending on the cause and where in the supply chain it becomes unwanted. The EC guidance on food waste reporting defines food loss as '*the loss of potential food prior to the harvest of crops or animal products*' while food waste is '*any food that has become waste under these conditions: 1. It has entered the food supply chain; 2. It then has been removed or discarded from the food supply chain or at the final consumption stage; 3. It is finally destined to be processed as waste.*' The FAO defines '*food loss and waste as the decrease in quantity or quality of food along the food supply chain. Empirically it considers food losses as occurring along the food supply chain from harvest/slaughter/catch up to, but not including the retail level. Food waste, on the other hand, occurs at the retail and consumption level*'.

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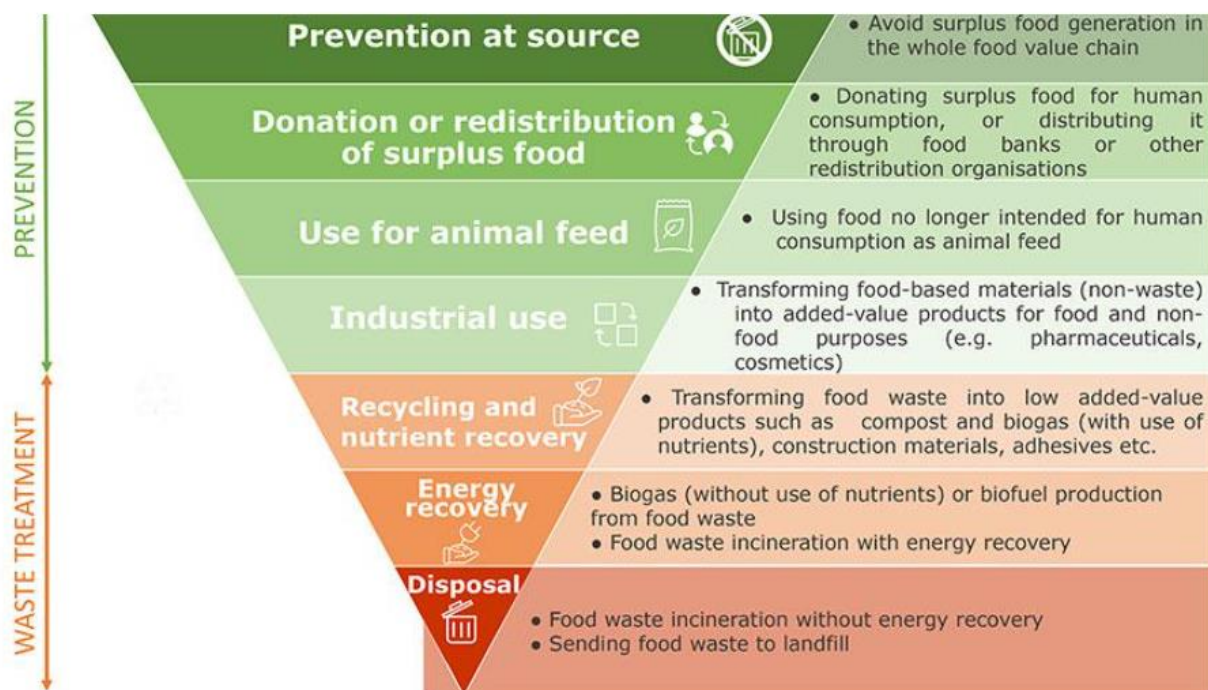


Figure 1: The Food Use and Waste Hierarchy. Source: European Commission Joint Research Centre, 2024

A targeted revision of the Waste Framework Directive 2008/98/EC (the WFD) was published in 2025.⁵

Food donation has been specifically highlighted within the WFD, as one means to help achieve the waste reduction targets:

'Member States shall take appropriate measures to prevent generation of food waste along the entire food supply chain, in primary production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services as well as in households. Those measures shall include at least the following:...

(c) encouraging food donation and other redistribution for human consumption, ensuring the prioritisation of human use over animal feed and the reprocessing into non-food products.'

Article 9(a) continues:

⁵Directive (EU) 2025/1892 of the European Parliament and of the Council of 10 September 2025 amending Directive 2008/98/EC on waste.

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'Member States shall, after consulting with food banks and other food redistribution organisations, take measures, where appropriate, on the basis of any existing national food donation system, to ensure that economic operators identified by Member States as having a significant role in the prevention and generation of food waste, propose donation agreements to food banks and to other food redistribution organisations so as to facilitate the donation of unsold food that is safe for human consumption, and at a reasonable cost to economic operators.'

There are specific targets for food waste reduction by 10% in processing and manufacturing, and by 30% at retail and consumption by 2030 (including restaurants, food services and households). There is no specific target for primary production, however the EU Commission will conduct a review of implementation progress of the current targets by 2027 as well a review of the root causes of food loss and food waste in primary production by 2027⁶.

Specifications

There are statutory and commercial quality specifications on produce, which affect whether produce is put on the market.

Fruit and vegetables, which are intended to be sold fresh to the consumer in the EU may only be marketed if they are sound (no rot, serious damage), fair, and of marketable quality and if the country of origin is indicated. Further specific marketing standards apply to certain types of produce (apples, pears, lettuce, sweet peppers, strawberries, and tomatoes are the relevant crops grown in Ireland). These are graded into: Extra (highest quality), Class I, and Class II.

The EU standards were revised in 2023⁷ and the new regulations came into effect in 2025. The rules were revised to alleviate food waste and loss by explicitly allowing fruits and vegetables that fail to meet quality or class criteria, but remain perfectly edible, to be marketed. Previously, EU marketing rules strictly required uniform size, shape, and appearance. Produce failing these quality standards often went unsold and became waste, even if perfectly edible. In addition, produce destined for processing, direct sales, or donation is exempt from appearance standards.

In Ireland, additional national standards under the Food Standards Act 1974 regulate potato size labelling.

⁶ https://environment.ec.europa.eu/news/revised-waste-framework-directive-enters-force-2025-10-16_en

⁷ Commission Delegated Regulation (EU) 2023/2429 and twin implementing Regulation (EU) 2023/2430.

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Retailers often impose stricter standards than EU public standards⁸ and consumer behaviour also plays a key role, as many shoppers remain reluctant to buy produce that looks different from their expectations.⁹ The Rosetta project is a 3-year project aimed at reducing food waste due to marketing standards through alternative market access. The project includes use cases in 5 European countries; in Ireland, it is being led by Teagasc and the target is to develop alternative solutions for the use of fruit and vegetables that do not comply with the 'quality' specifications but are still safe to be consumed. The analysis of public and private food marketing standards, food waste, and EU consumer perceptions is part of this effort. Rosetta Project business and policy recommendations are expected to be published in spring/summer 2026.¹⁰

Unfair Trading Practices

Unfair Trading Practices (for example short-notice cancellations of perishable foods) can cause food waste in the supply chain.¹¹ The Agricultural and Food Supply Chain Act 2023¹² gives effect to Directive (EU) 2019/633 on unfair trading practices in the agricultural and food supply chain. The Act establishes the Agri-Food Regulator as an independent office that promotes fairness and transparency in the food supply chain and examines potentially unfair trading practices between food businesses and food producers. The Agricultural and Food Supply Chain (Unfair Trading) Regulations 2023¹³ provide legal protection for any supplier of agri-food products against 16 specific unfair trading practices, including short-notice cancellations of perishable agricultural and food products.¹⁴

Irish food waste, horticulture, social and health policy, and the Programme for Government

The *National Food Waste Prevention Roadmap 2023-2025* (the Roadmap) is Ireland's strategy for food waste prevention, setting out the Government's policy, objectives and priorities in relation to food waste prevention. It refers to the conditions under which food donation is an appropriate option and notes that food surplus can be donated by food businesses once it is still in an acceptable condition and handled and distributed safely. The Roadmap makes commitments to look at policy levers that

⁸ Attard and O'Connor 2022.

⁹ O'Connor, T., Kleemann, R. and Attard, J. 2022.

¹⁰ The ROSETTA Project.

¹¹ REFRESH 2019.

¹² Agricultural and Food Supply Chain Act 2023, Act No. 19/2023.

¹³ S.I. No. 625/2023, Agricultural and Food Supply Chain (Unfair Trading) Regulations 2023.

¹⁴ subject to their annual turnover being lower than the buyer's turnover, once the buyer's annual turnover is greater than €2 million, Agri-Food Regulator 2026

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improve conditions for food donation, including Action 21. The *Whole of Government Circular Economy Strategy 2026–2028: Accelerating Action* is Ireland's second circular economy strategy and provides the wider policy framework for food waste prevention and surplus redistribution by prioritising waste reduction, resource efficiency and keeping materials in productive use for longer.

Implementation of Ireland's *National Strategy for Horticulture 2023-2027*¹⁵ is led by Bord Bia, Teagasc, DAFM and the IFA through the *Horticulture Industry Forum* (through the Horticulture Strategy). Amongst the many challenges noted in this strategy are growers leaving the sector, and food waste. Key Strategic Action 5 of the Horticulture Strategy calls for the following output: '*New knowledge creation and actionable advice from Irish and international research on relevant topics including suitable varieties, plant protection products, sustainable packaging, artificial intelligence, labour saving devices, reduction waste, growing innovation, climate adaptation, organic and integrated production, bioeconomy and circular economy is leveraged to drive innovation and create opportunities.*' There are specific actions in relation to subsectors (mushrooms, potatoes) to identify food waste reduction opportunities through packaging. Key Strategic Action 6.2 calls for the piloting of the collection of sustainability metrics, with Bord Bia and Teagasc leading on this. Mandatory reporting on food waste is also identified as a priority in Food Circle Report 1.

Ireland's Roadmap for Social Inclusion 2020-2025¹⁶ is Ireland's whole-of-Government anti-poverty strategy. It establishes a goal to ensure that all people can live with confidence that they have access to food. Healthy Ireland¹⁷ is the Irish Government's whole-of-society framework to improve health and wellbeing. Delivery is guided by the Healthy Ireland Strategic Action Plan 2021-2025. While food donation and agricultural recovery are not specifically listed, Healthy Ireland's system-wide goals are relevant. Goal 1 is to increase the proportion of people who are healthy at all stages of life; and goal 2 is to reduce health inequalities. Both Healthy Ireland and the Roadmap for Social Inclusion finish at the end of 2025; a national programme of agricultural recovery will likely also be relevant for the goals and objectives of successor plans.

The 2025 Programme for Government¹⁸ commits to circular-economy progress and waste reduction. It also commits to supporting a sustainable transition in agriculture, specifically to '*Support Irish farmers and food producers to continue to produce world-class food whilst reducing greenhouse gas emissions and improving*

¹⁵ National Strategy for Horticulture 2023-2027.

¹⁶ Roadmap for Social Inclusion 2020-2025: Ambition, Goals and Commitments.

¹⁷ Healthy Ireland: A Framework for Improved Health and Wellbeing 2013-2025.

¹⁸ Programme for Government 2025: Securing Ireland's Future, 2025.

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economic, social and environmental sustainability in agriculture.' The programme also provides that *'strengthening farm incomes for our 130,000 family farms is an absolute priority...'*

3. Volume and causes of farm-level food loss in Ireland

The Central Statistics Office Farm Structure Survey 2023 confirms that there are approximately 133,000 farms in Ireland; of which approximately 1% are involved in fruit and vegetable production.¹⁹ In 2024, field vegetable production, covering an estimated 4,395 hectares, was valued at €109,383 million at the farm gate, according to DAFM. Teagasc highlights that *'Vegetable production in Ireland is an important part of the horticultural industry [...] Production is concentrated in Dublin, Meath, Wexford and Cork, with approximately 200 growers. The largest 50 growers (in terms of area) account for 75% of the total field vegetable production area.'*²⁰ More recent estimates suggest that there may be just 74 commercial field vegetable growers left in Ireland (those growers registered with the Bord Bia Sustainable Horticulture Assurance Scheme or the Bord Bia Horticulture Producer & Pre-packers Standard and excluding growers who exclusively grow potatoes, top fruit and glass house vegetables). The challenge of growers leaving the sector was highlighted in the Horticulture Strategy Mid Term Review.²¹ Teagasc further highlights the pressures for vegetable growers: *'Fresh vegetable prices hit their lowest level of €1.46/Kg in August 2020, and peaked at €1.87/Kg, in December 2007 (Bord Bia, 2023). From a field vegetable producer perspective, margins have reduced over this timeframe while the costs associated with field crop production have increased immeasurably during this nineteen-year period, by 42.9% since 2021.'*²² They list the cost of labour, the cost and availability of accommodation and of suitable land for farming as key contributors to the challenging environment. Teagasc concludes: *'Margin over costs for primary producers will need to improve, as well as longer term sourcing agreements to incentivise investment and allow generational renewal of businesses.'*²³

¹⁹ Central Statistics Office Farm Structure Survey 2023. Horticulture is classified as 'Other' farm type: 1,872 of the total number of farms (133,174).

²⁰ Teagasc Fact sheet Horticulture 6 Field Vegetable Production (v 1 2020)

²¹ National Horticulture Strategy Mid Term Review presented at the Horticulture Industry Forum, November 2025.

²² Teagasc Horticulture Crop Input Prices 2024

²³ Teagasc Horticulture Crop Input Prices 2025

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From a review of available data and resources in this area, we estimate that Ireland produces between 47,000²⁴ and 94,877²⁵ tonnes of edible surplus food each year. Edible surplus is food that could still be used in processing, valorisation or redistribution. Focusing on redistribution only, applied to a selection of 13 fruit and vegetable crops and using the Andersons Centre methodology (for its report for FareShare UK), we estimate that at least 21,000 tonnes could be available for redistribution annually in Ireland²⁶.

This is a desktop estimate of a baseline of existing levels of farm-level food waste but, as highlighted in the Horticulture Strategy, there is a lack of publicly available data. Further work is ongoing in this area to gather more data at farm-level. The RETAIN Project²⁷ aims to address gaps in data relating to non-husbandry and climate-related causes of food waste and loss and their impacts. However, results will not be reported until September 2026.

The EPA-funded research report *Food Loss and Waste from Farming, Fishing and Aquaculture in Ireland*²⁸ found that the main cause of horticultural FLW is producers being unable to sell harvested produce, due to produce not meeting retail specifications and seasonal lack of consumer demand (31%). The second-most prevalent cause of FLW is produce being excessively difficult to harvest, due to losses from harvest machinery or root vegetables being too deep in the soil to harvest (28%). Additional causes of horticulture FLW are pests and disease (17%), respiration and moisture losses (in storage) (11%), environmental conditions and weather-related disruptions e.g. flooding (8%) and pre-sale processing losses e.g. during handling in the packhouse, including trimming of vegetables to meet specifications such as mushroom stalks (4%)²⁹.

In 2022 researchers from MTU (in collaboration with FoodCloud) conducted a study to identify the extent and nature of farm surplus available for redistribution, and the

²⁴ The WWF Hidden Waste Report found that 87% of farm loss was edible; applying that figure to the EPA's 2024 total of 54,000 tonnes at primary production is just under 47,000 tonnes.

²⁵ O'Connor et al. 2022, see the Supplementary Data for categorisation of FLW into edible and not edible; total 94,877 tonnes of the total 126,199 tonnes of field vegetables, protected vegetables and fruit. Categorisation completed by FoodCloud in November 2025 and reviewed by O'Connor (see Appendix 10).

²⁶ King, R. and Webster, J. 2023, The Andersons Centre Report, applied to Irish annual production of 13 fruit and vegetables, see **Appendix 1**.

²⁷ RETAIN, ongoing.

²⁸ O'Connor et al. 2022.

²⁹ O'Connor, Kleemann and Attard 2022.

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existing pathways for disposing of farm surplus (the 'MTU 2022 Research').³⁰ The MTU 2022 Research identified two main factors associated with loss at the growing, harvest, and packhouse and sale stages (see the full report at Appendix 2). The two main factors were: environment/farm factors, e.g. pests and crop management, and market/customer factors, e.g. an unexpected decline in demand. Most farmers reported having edible surplus (77%) although donation to keep the food in the human supply chain was only undertaken by 6% of farmers surveyed. Other pathways for the surplus included leaving food unharvested (52% of farmers), using it as compost or spreading directly on fields (39% of farmers), or anaerobic digestion (3% of farmers). The main challenges farmers said hindered their ability to donate surplus food included: logistics (48%), time (39%), process management (29%), storage (10%), and packaging (10%).³¹ The proportion of field crops lost varied widely with one quarter of farmers citing losses on the high side, i.e., between 20-50% of their potential crop.

Mandatory FLW reporting and a more consistent methodology (for example using the WWF Global Farm Loss Tool, the WWF Tool) would provide a more accurate picture (as current research is largely based on farmer's own estimates). The WWF Tool provides a structured way to measure on-farm waste by categorising leftover produce as (i) marketable and edible; (ii) edible but not marketable; or (iii) spoiled. This is an approach not previously applied systematically in Ireland, but it is being tested in other countries to reveal reasons for loss linked to product specifications and aligns with the Horticulture Strategy's call for stronger baseline data on food waste.

FoodCloud tested the WWF Tool with one of its farm partners, generating some initial data and practical lessons, though more extensive measurement is needed (see Appendix 3). The RETAIN project is also using the Tool with Irish growers. The RETAIN project results are not expected until September 2026 but as of November 2025, RETAIN researchers were able to confirm that they had identified no additional causes of primary production FLW.

Case studies

Although there is limited data in this area, as outlined above, FoodCloud's Growers' Project experience and anecdotal evidence from the case studies below illustrate the significant level of horticultural surplus available at Irish farms.

³⁰ Desk-based research, which informed subsequent interviews with, and surveys of, 31 farmers about their food waste and donation experience. This represented 12% of the approximately 260 commercial fruit and vegetable farmers registered with Bord Bia in 2021.

³¹ 6% of the producers surveyed in Attard and O'Connor (2022) and 5% in Fox et al. (2023).

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Case Study #1 Commercial Carrot Grower

The carrot case study is a mixed farming operation based in Leinster. The farm consists of over 250 hectares of crops, including carrots, parsnips, pumpkins, cereals, flower bulbs, onions and grassland. Crops and cereals are produced for domestic and export supply with most of the produce processed and packed on site before distribution to the major retailers. The grower estimates that 60% of annual carrot production is viable Grade 1, while a further 20% could be deemed Grade 2, with the remaining 20% being diverted to animal feed. This grower estimates that they could supply FoodCloud with 320 tonnes of Grade II annually, being carrots that are outside of retail specification or are not required for a retail contract (grown to ensure that the retail contract is met). This producer is looking at potential valorisation avenues, but significant investment is needed for suitable machinery.

Case Study #2 Commercial Potato and Onion Grower

In 2024, FoodCloud visited a large Irish potato producer to discuss potential solutions for their surplus potatoes. They advised that at peak production, they could send 80 tonnes of potatoes to animal feed per week, being potatoes that fail to meet retail specification and those which would not be suitable for human consumption (i.e. greening, harvest damages and rot). That is a simple solution for the producer as they do not have the time or resources for other avenues, and they receive a small return (€40-60 per tonne). At a conservative estimate of 8 weeks of harvesting (in a typical season, late August to mid-October), one producer could therefore have 640 tonnes of surplus potatoes. Even if only 50% of those were suitable for human consumption, over 300 tonnes would be available from just one producer per harvesting period. There are also other potatoes that might be sent to the distributor but then returned if they fail the quality spot checks. If they are rejected by the distributor, they are returned to the producer. As they are already bagged, these could be diverted to food redistribution organisations and redistributed rather than sent for animal feed but there would need to be a simple process for this and compensation for the grower to incentivise this use.

This grower also produces onions for the retail market and sends all onions outside of specification (skinned or smaller sizes) to animal feed. After reviewing its processes, this producer is now sending potatoes to chipping and to a third-party food grade potato starch producer so that lower amounts are being sent to animal feed. It is another process for the producer to incorporate into its operations but does generate some revenue.

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Based on this evidence of significant farm-level surplus, we are recommending the investments in prevention through prevention at source, through market-oriented waste prevention initiatives that keep surplus in the human food chain, and through compensated agricultural recovery, as set out in the following sections.

4. Solutions

Prevention at source

Prevention at source is the first priority of the Food Use and Waste Hierarchy (see figure 1). This means stopping loss and waste before it happens. Attard and O'Connor provide a comprehensive summary of interventions that can prevent FLW at source categorised by type of capital (natural, physical, social, human and financial).³²

Interventions proposed by stakeholders can also be categorised as follows:

- A. Data: Improve data on farm-level losses to understand volumes, causes, and drivers, and use insights to develop commodity-specific food-waste reduction action plans³³.
- B. Collaboration: More collaboration between farmers and retail actors³⁴ or a multi-stakeholder working group on product specifications and innovation.³⁵ The creation of short food supply chains that strengthen the connection between producer and buyer.³⁶
- C. Regulation, specification and contracts: Regulate to prevent unfair trading practices (UTP) between food businesses and food producers (as per the Directive on UTP) and enforce against any such practices. Review all aspects of specifications, including the role of consumers in product specifications and

³² Attard and O'Connor, 2022.

³³ National Strategy for Horticulture 2023-2027, Key Strategic Action 5 - Research and Development for the Industry & Key Strategic Action 6.2 - Collect Sustainability Metrics (Horti-enviro-metrics).

³⁴ Attard and O'Connor, 2022.

³⁵ [The Horticulture Sector Action Plan for Food Waste Reduction 2024 Technical Report](#)

³⁶ The idea of short food supply chains (SFSCs) is to cut farm-level loss and waste by bringing producers and buyers closer together so surplus can be forecast, priced and moved quickly—often with more flexible specifications, shorter lead times, and local logistics that absorb 'grade II' crops through direct B2C sales or targeted B2B channels (e.g. food hubs, public kitchens). EU projects show how this works in practice: **agroBRIDGES** builds multi-actor platforms, tools and business models that help farmers switch to SFSC routes, reducing intermediaries and creating faster outlets for seasonal gluts; **PLOUTOS** pilots combine collaborative business-model innovation, data-driven services and behaviour change so supply and demand align earlier in the chain, aiming to prevent edible produce from becoming waste. In Ireland, **Cultivate** leads living-lab work to train SFSC advisors and support local food facilitators, strengthening the human 'infrastructure' to turn potential surplus into marketable product more quickly.

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highlighting the impact of consumer choices on food waste.³⁷ Explore alternative contractual models—such as whole-crop purchase or wage-style contracts—to give farmers security while reducing waste linked to cosmetic standards.³⁸ Conduct whole-chain food-waste reduction studies to identify joint, cross-supply-chain actions that cut losses from 'farm to fork'.³⁹

- D. Labour: Address labour shortages, for example by progressing a permanent seasonal-worker scheme to ensure reliable harvest labour or support for the deployment of automated harvesting technologies to increase labour efficiencies and support waste-reducing efficiency in horticulture.⁴⁰

Market-oriented waste prevention initiatives

If FLW cannot be prevented from arising in the first place, it can be prevented from going to waste by market-oriented waste prevention initiatives such as:

- A. Discounting: All the major retailers operating in Ireland have introduced mechanisms to reduce in-store waste. Some will have a reduced to clear section (e.g. Tesco), surprise boxes (e.g. Lidl Waste Not boxes of produce) or via Too Good to Go to sell surprise bags of food, which may include produce, at a discount (e.g. Aldi). Individual farms like Green Earth Organics offer a wonky vegetable product and Bockety Box is working with Irish growers to supply surplus vegetables to consumers. In the UK there are at least two companies selling surplus vegetables: Oddbox and Wonky Veg Boxes.
- B. Valorising: This means transforming produce into a different product for which there is a market. For this report valorising only refers to processing into other edible food products.⁴¹ Surplus food can be given an extended shelf life or delivered in a way that is more accessible for the consumer. Innovations in this space can be introduced that have broader food systems and social benefits

³⁷ Fox S et al. 2023 note '*The disconnect between the consumer and the industry in terms of how consumer expectations impact the produce on the supermarket shelves is clear. An open, transparent dialogue between all stakeholders, including consumers, is critical if this narrative is to change. It was recognized that by sharing the current sustainability measures already in place through education with their own staff initially, followed with their customers, may start a positive chain of discourse that ultimately reaches all parties, bringing the food waste dilemma into the public arena. Then, food waste revalorization could offer products acceptable to consumers, and in turn, a viable business model for stakeholders. Education could lead to consumer understanding of the benefits of revalorization, increasing further the acceptability of the products.*'

³⁸ ECR Retail Loss 2020. This is described further in a report by the ECR Retail Loss Group: [Contractual Terms for Reducing Food Waste](#)

³⁹ A toolkit for undertaking a whole chain study along with case studies from WRAP's work in the UK is available [online here](#). Case examples from [work in the US](#) are also available as well as examples in Australia.

⁴⁰ National Strategy for Horticulture, 2023-2027, Key Strategic Action 3.

⁴¹ Valorising can also refer to processing surplus to non-food products, but this would be considered industrial use for the food use and waste hierarchy and is not considered in this report.

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(e.g. FoodCloud Kitchen Meals on Wheels community meals provision⁴²). Meade Farm's approach to surplus potatoes is highlighted in case study #3 below.

- C. Secondary markets: Refer to both direct to business or consumer markets for excess produce, whether in or out of specification. This section reviews international and Irish research and innovation in valorisation and secondary markets as prevention solutions.

Case Study #3: Meade Farm

Meade Farm has been a core FoodCloud partner since 2017, donating 240 tonnes of surplus food (to Q3 2025), the equivalent of 572,379 meals, to communities through FoodCloud. In 2020, the farm invested in equipment to establish the UK and Ireland's only food-grade starch facility, which converts surplus potatoes into starch for human consumption. Meade Farm now uses FoodCloud's tech platform, Foodiverse, that connects surplus food to local communities, and the surplus food benefits four charities in the Meath/Louth/Dublin area. This adoption has delivered a further 20 tonnes of short dated surplus across 2024-2025. Any remaining surplus unsuitable for people is sent to local livestock feed. By valorising surplus, donating edible produce, and diverting the rest to animal feed, Meade Farm operates a zero-food-waste model, and is an example of a food producer that follows the principles of the food use and waste hierarchy, and whose surplus has decreased through active measurement and management.

There are numerous other examples of discounting, valorising and secondary markets in Ireland and internationally. A list of these is included in Appendix 4. These models experience challenges around stock variability, processing and logistics capacity, market building and buyer acceptance, and digital marketplace adoption (onboarding producers, data interoperability, fulfilment). The reference in the Horticulture Strategy of the processing industry's limited capacity is noted, as is the need for further research and development. DAFM's Scheme for Innovation and Diversification in Horticulture (Capital Investments) was established to provide primary producers with access to funding for innovation and diversification investments including relating to valorising food waste. The Scheme for Innovation and Diversification in Horticulture (Desk studies/research) similarly supports primary producers' investigation into alternative options for their produce.

⁴² <https://food.cloud/foodcloud-kitchen>

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Donation and redistribution

If food surplus cannot be prevented at source, or through market-oriented initiatives, food redistribution is the next best solution to reduce the volume of food waste. Agricultural recovery is the collection and redistribution of safe, edible surplus crops from farms and fields, which is given to community groups to feed people who need it. It can include: (i) unpaid donations; (ii) gleaning (where volunteers are engaged to collect surplus produce that has not been harvested by the farmer); or (iii) 'compensated recovery', where the grower is partially compensated for the cost of food that is donated. Agricultural recovery is a way to ensure that farm-level surplus does not go to waste, that vulnerable communities are able to access nutritious food, and that the overall environmental impact of food production is minimised. Compensated recovery means that food security is reinforced and farmers are supported; as highlighted by the O'Connor et al. research in 2022, there are barriers to farmers donating in relation to logistics, time, process management, storage and packaging; compensation towards these costs allows surplus produce to be redistributed.⁴³

Generally, while gleaning may still occur around the country, it is mostly a historical concept⁴⁴ rather than as a routine feature of modern farming. FoodCloud coordinates a small-scale gleaning programme with volunteers on farms near its Dublin Hub to glean vegetables during the harvest season. Volunteers recovered 3.8tn of vegetables in 2025, 8.1tn in 2024, and 5.4tn in 2023 (a total of 17.37 tonnes over 3 years). As well as the surplus recovered, this gleaning plays an important awareness-raising role amongst volunteers around the food system and the challenge of FLW.

In 2022, inspired by ad hoc donations of gleaned apples, FoodCloud began a pilot project on apple gleaning. The results of the pilot were set out in a report called the '*FoodCloud Apple Gleaning Project*'⁴⁵ (see Appendix 5). The initiative demonstrated a means of valorising surplus apples into a marketable, shelf-stable product. Juicing fruit and vegetables has become a regular part of FoodCloud's operations. In 2024 the product line was expanded to carrot and apple juice. In 2025 FoodCloud worked with Falling Fruit, and Tipperary Apple Farm to juice 3,600 kg of gleaned apples and surplus carrots into 3,300 bottles of juice.

Research highlights the barriers to traditional donation and gleaning:

⁴³ This report focuses on horticultural surplus.

⁴⁴ See McGarry Dr M.

⁴⁵ Hurley, M.A., O'Connor, T., Snowling, N. & Curtin, B. 2023.

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1. Cost - the horticulture sector is extremely competitive with low profit margins. There is no incentive for producers to spend time and money on harvesting, packaging or transporting surplus they cannot sell.
2. Logistics - coordinating on-farm collection windows, transport, and (where needed) chilled storage is difficult and often exceeds producer and / or volunteer capacity.
3. Labour and other inputs - the producer's time is constrained and labour is short. Donations still need to be sorted and packaged, and resources are needed for this. Scheduling, traceability and food-safety paperwork all require an administrative resource.

5. The Growers' Project

FoodCloud receives donations of surplus fruit and vegetables. However the challenges are that the supply is not generally consistent (due to the nature of surplus food) and that charity demand exceeds supply. Understanding the barriers set out above, and inspired by FareShare's Surplus with Purpose programme in the UK, FoodCloud sought to test compensated agricultural recovery in Ireland. With funding from DAFM (through the Rural Innovation and Development Fund) and philanthropic sources, FoodCloud has piloted different operational models of compensated agricultural recovery over the last five years (the Growers' Project); initially supplying its own network on a small scale and then increasing between 2023 and 2025 to work with Local Development Companies or community partners to redistribute larger quantities of vegetables and to access rural communities that it was not previously able to access (particularly the counties of Donegal, Kerry and northwest Cork). Since piloting the project in 2021 to the end of 2025, FoodCloud has redistributed nearly 700 tonnes of farm-level surplus from 9 growers to 237 community groups, delivering over 1.6 million meals equivalent.

The Growers' Project has achieved the following key results:

Growing Season	Vegetables distributed from farms (tonnes)	Growers	Recipient community groups	Meals equivalent	Emissions savings (tonnes)	Costs recovered by growers	Retail value
2021-22	30	5	116	72,969	98	€13,621	€29,900
2023-4	92	5	182	217,770	293	€54,986	€175,852
2024	235	8	207	560,252	424	€96,683	€395,71
2025	330	8	208	785,400	594	€145,000	€499,920
Total	686.9	9	211 different groups	1,636,391	1409tn	€310,290	€1,102,197

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Demand for Growers' Project produce has increased significantly year-on-year, and feedback from recipient community groups has been overwhelmingly positive:

'The fresh vegetables we have received has been without a doubt keeping us afloat here for the last year. We send out over 700 meals a week here and are open 7 days a week 365 days a year. The seasonal increase in the cost of potatoes this year would have actually crippled us and we were very fortunate to receive a huge amount from FoodCloud. We operate in a very rural area in Mayo so our transport costs are high. We charge €8 for a hot 3 course meal. We really feel that we cannot increase the meals any more as we will be pricing the most vulnerable in our community out. The need to make the meals affordable to all our elderly is our utmost priority.' (Brickens Meals on Wheels, Mayo)

There is also demand from groups that FoodCloud does not currently supply with this produce: 99% of 93 community partners surveyed in November 2024 confirmed they would use the Growers' Project vegetables if they were available in their area. The Growers' Project has also enabled FoodCloud to set up a Hub and Host programme to work with larger community partners who act as a local redistribution location for smaller community groups in Kerry and Kilkenny (for more information on this, see Food Circle Report 4.)

Benefits and opportunities

Like any food redistribution measure, agricultural recovery has multiple environmental, social and economic benefits. The recovery and redistribution of fresh, nutritious produce has the potential to deliver greater health benefits than surplus food in general.

The challenge presented by growers leaving the industry is highlighted in the National Strategy for Horticulture 2023-2027. Compensated recovery would have a small economic benefit for participating producers, and would support those in the horticulture sector and Ireland's food security (in the sense of making it more likely that Irish grown produce continues to be available). If all of the edible FLW was used rather than going to waste, it is suggested that this could potentially increase domestic horticulture productivity by 15.8% (Appendix 10, Table 2) (supporting UNSDG target 2.3 and 2.4).

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The benefits can be summarised into three categories:

Environmental
• Reduces food waste, which is a significant contributor to climate change (8-10% of global emissions). • When food is lost or wasted, the land, water and fertiliser used to produce that food also go to waste. • Reducing food waste can decrease the environmental impact of food production.
Nutritional and social
• Benefits community groups with fresh local produce and connects them with local farmers. • Supports charities helping people in food poverty. Makes a significant contribution to providing a healthy and nutritious diet to a growing global population. • Ensures more of the global food supply is used to feed people, addressing hunger and malnutrition. • Improves quality of health and life, leading to happier individuals. This is particularly important in light of the 2024 Healthy Ireland survey which highlighted that only 28% of the population reported eating five or more portions of fruit and vegetables each day, 6 points lower than reported in 2019. • Provides social connection and interaction around food, acting as a gateway for other support and combating isolation.
Economic
• Helps farmers, companies, and consumers save money. Avoids the waste of significant input costs (land, machinery, labour, capital, fertilisers) incurred during food production. • Promotes more sustainable food production, providing employment and benefiting rural economic activity. • Food businesses can eliminate costs related to storage, warehouse capacity, and dealing with food waste. • Community groups and individuals save money on food bills, which allows community groups to use funds for their core services and for individuals, it helps to relieve financial pressure on food budgets, allowing funds for other essentials like school activities or fuel. • Provides better financial viability for growers if they receive contributions for their donations. • Positive health outcomes from nutritious food can ultimately save money on healthcare provision. • Reduces carbon emissions, potentially saving fines associated with global environmental commitments.

Table 1: Summary of the environmental, nutritional, social and economic benefits of compensated agricultural recovery. Source: The Power Report, 2025⁴⁶ and the Healthy Ireland Survey 2024

⁴⁶ Power, J., 2025.

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6. An Irish national compensated agricultural recovery programme

Impact and cost

A national, compensated agricultural recovery programme could redirect 5,000 tonnes of Ireland's farm-level horticultural surplus each year by 2030, getting this food to people who need it, saving approximately 9,000 tonnes of carbon dioxide equivalent emissions from waste. This is based on our understanding of how much edible surplus is available and feedback from growers and community groups.

It is recommended that the 5,000-tonne annual target be achieved in stages over five years, to ensure the programme is both administratively feasible and matched to community demand. There is potential for Producer Organisation (PO) market withdrawal funding (see below) to supply a portion of this tonnage target, in which case direct costs to growers for that produce would be compensated through the PO structure (EU funding).

The following is a five-year model, including environmental and social impact (tonnes of surplus saved, approximate emissions saved from going to waste, meals equivalent shared). The estimated annual cost by 2030 is €3 million (contribution to growers, transport and logistics and FoodCloud operational and warehousing costs).

Environmental and social impact	2026	2027	2028	2029	2030
Tonnes of surplus	350	630	1,260	3,150	5,000
Emissions saved from going to waste (tonnes CO ₂ equivalent)	900	3,600	5,400	7,200	9,000
Meals equivalent shared	833,333	1,450,000	3,000,000	7,499,999	11,904,762
Number of growers	8	20	30	40	50
Number of community groups	240	300	350	400	450

Models and funding of compensated agricultural recovery

There are different operational and funding models of agricultural recovery. Farmers' costs can be recouped either through direct payments or tax credits, and schemes are variously funded at EU and national levels, or through private funding. Please see Appendix 6 for more details on approaches in other jurisdictions.

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Different models for compensated agricultural recovery include:

1. Producer Organisations (POs) can utilise funding through a market withdrawal mechanism accessed via the EU PO scheme, where gluts of produce are donated to food banks and farmers are compensated (up to 5% of annual production, including transport costs). Growers in France, Italy, Portugal and Spain are widely organised into POs and use this mechanism frequently.
2. Government grants have been made in France and the UK, and of course in Ireland. In 2019, the UK-based food redistribution organisation FareShare launched a £3 million 'Surplus with Purpose' fund with support from the UK Department for Environment, Food and Rural Affairs⁴⁷. This fund covered the costs of food recovery for farmers, as well as other food supply chain actors, including costs of production, storage and transport, up to a maximum of £50,000⁴⁸. FoodCloud's Growers' Project was inspired by this project.
3. Philanthropy used to supplement publicly funded programmes. In Ireland, Tesco partnered with FoodCloud during the first year of the Growers' Project, with philanthropic support from other funders secured in years 3, 4 and 5.
4. Tax credits for donated produce. In the US, this is accompanied by funding to administer 'Farm to Food Bank Projects'.⁴⁹ An example of how this works is the Farmlink Project,⁵⁰ an organisation that connects farms with surplus produce to food banks and funds. All shipping and logistics costs are covered by Farmlink, and they will also help farmers maximise their tax benefits. In Spain there is VAT relief on donations, as well as tax relief. In Colombia, the 'Recovery of Agricultural Surpluses' (REAGRO) programme of the NGO ABACO aggregates farmers' surplus for redistribution through the food bank network, with farmers receiving compensation through tax deductions for their donations and the logistics organisation and costs managed by ABACO (2020).

⁴⁷ FareShare, 2022.

⁴⁸ FareShare proposed that the UK government run a trial with surplus food as a standard under the Sustainable Farming Incentive in England (the Andersons Centre report, **Appendix 1**). This envisages payment by the government to the grower for donation of surplus food, based on a standard rate per tonne delivered (with pre-agreed rates for each vegetable). FareShare was awarded £1.9m to pilot this project and following the success of that pilot project, requested an annual grant from DEFRA of £5m (FareShare 2021). In June 2025, £13.6m of government funding was announced to rescue 19,000 tonnes of farm surplus. (See UK Government press release dated 10 June 2025, [Tackling Food Surplus at The Farm Gate Scheme](#)). FareShare has now merged with the Felix Project, a redistribution organisation specialised in redistributing fruit and vegetables. It commissioned a further study calling for investment in recovery that was published in July 2025; *Investigating the economic and environmental impact of including surplus food redistribution in the UK government's Sustainable Farming Incentive (SFI) scheme* (FareShare - Felix, 2025).

⁴⁹ US Department of Agriculture, Food and Nutrition Service 2026.

⁵⁰ See <https://www.farmlinkproject.org/> accessed 24 November 2025.

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FoodCloud commissioned *Recommendations for an Agricultural Surplus Redistribution Programme in Ireland*, a report by economist Jim Power,⁵¹ to develop the business case for compensated agricultural recovery in Ireland and to suggest appropriate funding models to support a national programme. Having examined various models of compensated agricultural recovery, the report concludes that:

- *In the short-term the most appropriate approach for Ireland is direct funding from the Government. To achieve maximum results and address the many issues associated with food waste, a multi-year funding programme should be created to generate certainty and continuity.*
- *In the longer-term, it is recommended that policymakers move towards a model of tax incentives, covering the costs of the primary producer. The quantum of the incentive, the size of the company eligible to receive it, and the need to avoid market distortion will all need to be considered as to how this would work in Ireland and further work is required in this regard. Alternatively, at an EU level, if this programme were included in the CAP,⁵² producers would be able to supply food banks with produce and claim payment directly from the EU.*

The Horticulture Strategy identifies collaboration through the PO scheme as a key strategic action⁵³. In Ireland, the horticulture sector is not organised in POs to the same extent as some other EU Member States. However, for sectors that are organised in this way, POs market over 60% of the fresh produce in that sector.

The market withdrawal mechanism within the PO scheme is not a standalone solution because it only applies to those growers who are part of a PO. It does not apply to potatoes (which are a significant crop and source of surplus in the Irish context) and would not cover costs incurred by redistribution organisations. It also entails significant administrative requirements for both the PO and the Member State paying agency. However, it could provide an important means of supporting growers in respect of gluts and has good potential to form one element of a wider surplus recovery approach.

At EU level, there are potentially several funding routes for this programme. Under the proposed post-2027 CAP architecture, these may include CAP interventions delivered through Ireland's future CAP chapter within the National and Regional Partnership Plan, including successor measures to existing agri-environment-climate, rural development, cooperation, innovation and PO support. The European Federation of

⁵¹ Power, J. 2025.

⁵² EU Common Agricultural Policy.

⁵³ Key Strategic Action 1, National Strategy for Horticulture 2023-2027 (an element of Food Vision 2030)

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Food Banks has proposed that the post-2027 CAP should explicitly provide for the co-financing of surplus recovery from primary production, with redistribution to people prioritised over animal feed and anaerobic digestion (see Appendix 9). Other relevant mechanisms could include LEADER, or its post-2027 successor arrangements within the proposed CAP and National and Regional Partnership Plan architecture, as well as other relevant rural or community-led development measures. FoodCloud therefore recommends that, alongside market withdrawal funding available through PO scheme, relevant CAP and wider EU funding mechanisms, or their post-2027 successors, be explored to support a national agricultural surplus recovery programme.

We recommend scaling up a compensated recovery programme aiming to redistribute 5,000 tonnes of food annually by 2030, with all the environmental and nutritional benefits that will achieve, as outlined in this report. We recommend the provision by the Government of multi-annual direct funding as the core short term funding mechanism for the programme, while also pursuing alternative options for EU funding. To date, funding from the DAFM Rural Innovation and Development Fund and philanthropic sources has created substantial impact and enabled FoodCloud to design a programme that is feasible, sustainable and scalable. Whether by increasing current Exchequer support, accessing EU funds, or a combination of both, multi-annual funding would enable delivery partners, as well as cost and food recipients, to plan ahead maximising efficiency and impact.

Cost benchmarking and state aid

FoodCloud sought advice on the state aid status of any direct funding from the Government used to cover growers' costs of donation. Payments to cover producer costs using government funding are considered state aid only to the extent that they exceed the 'market rate' (i.e. the notional rate the producer could get for the donated produce). If the payments are above the market rate, the excess amount could be classified as state aid. Any excess over the market rate would be subject to the EU's 'de minimis' threshold for agricultural-related funding, which caps the total aid a producer can receive at €50,000 over a rolling three-year period. Since the donated produce, which would otherwise go to animal feed, anaerobic digestion, or disposal for nominal or no payment, lacks a clear commercial market for human consumption, establishing the market rate is a crucial step.

The programme must benchmark the rate against price to ensure that it is not paying above market rate, or if it is, to monitor the amount above the market rate to comply with the state aid limit. Under the updated EU PO legislation, DAFM sets the rates of the costs due to POs for market withdrawals. As national rates set by DAFM are not yet available, to determine the appropriate market rate, FoodCloud has used the EU

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PO valuation method for market withdrawals in the original legislation, which is an established, EU-approved process.⁵⁴ This method calculates a total value per tonne by covering three components: (1) compensation for the value of the withdrawn products (based on EU-set maximums or 40% of the five-year average market price for non-listed products), (2) flat-rate amounts for sorting and packaging, and (3) flat-rate amounts for transport. Applying this PO valuation method to the produce distributed to date in the Growers' Project shows that FoodCloud's average current rate paid per tonne is generally comparable to or lower than the calculated PO method value (see Appendix 8), suggesting the payments are generally within an acceptable benchmark and are not exceeding the market rate such that the payments do not constitute state aid. When the DAFM rates are available and/or if there is other data or an alternative valuation method that could be used for this calculation, FoodCloud can adapt its current approach.

7. Conclusion and recommendations

Farm-level horticultural surplus in Ireland is substantial. In line with the food use and waste hierarchy, surplus should first be prevented at source, then managed through secondary markets and valorisation. Where safe, edible surplus remains, food donation and agricultural recovery are effective methods of food loss and waste prevention through redistribution options that prioritise human consumption over lower value outlets. FoodCloud's Growers' Project has demonstrated that compensated agricultural recovery is feasible in Ireland. Community groups have indicated there is a significant 99% of 93 community partners surveyed in November 2024 confirmed they would use the Growers' Project vegetables if they were available in their area. A national compensated agricultural recovery programme, targeting 5,000 tonnes of surplus per year by 2030, could save approximately 9,000 tonnes of carbon dioxide equivalent emissions from going to waste annually, while supporting vulnerable communities with access to fresh produce and providing an additional outlet and covering some costs for growers.

As Ireland moves towards 2030, there is an opportunity for the development of a medium term, national programme for agricultural recovery that will showcase Ireland's leadership in the circular economy and sustainable farming, while protecting growers and food security, and addressing our United Nations Sustainable Development Goal and EU obligations, and Action 21 of the Roadmap, as well as the National Strategy for Horticulture, Healthy Ireland, the Roadmap for Social Inclusion, and Programme for Government commitments on circular economy and farm incomes.

⁵⁴ The setting of these rates for all products is now left to the Member States, but FoodCloud has used this method as it was approved at EU level in the original legislation.

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The indicative annual cost of approximately €3 million by 2030 is modest relative to the social, environmental and economic benefits set out in this report, and is achievable if multi-annual funding is secured, either from Irish Government or EU sources.

This report puts forward the following key recommendations:

A. Support for a national compensated agricultural recovery programme

A.1	Establish a medium term national compensated agricultural recovery programme, building on the Growers' Project, enabling redistribution of 5,000 tonnes of surplus each year by 2030, using the five-year impact and cost projections set out in this report.
A.2	Embed agricultural recovery and surplus prevention in successor strategies to the National Food Waste Prevention Roadmap, Healthy Ireland and the Roadmap for Social Inclusion, and in implementation of the National Strategy for Horticulture, so that farm-level surplus and redistribution are recognised as cross-cutting policy tools.
A.3	Provide multi-annual direct Government funding as the core short term funding mechanism for the programme, while also pursuing alternative options for EU funding.

B. Invest in and support food waste prevention in the order established in the Food Use and Waste Hierarchy

B.1	Invest in prevention at source by improving data on farm-level losses, supporting the use of structured tools such as the WWF Global Farm Loss Tool, progressing mandatory FLW reporting (while recognising any burden this places on growers), and promoting collaborative work on specifications, contracts, labour and logistics that will reduce surplus.
B.2	Support market-oriented waste prevention initiatives that keep surplus in the human food chain, particularly valorisation activities that create marketable and / or shelf-stable produce, promoting avenues to use

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	these valorised products as part of socially or nutritionally beneficial initiatives (such as for use in institutional settings such as school meals, hospitals, social supermarkets, Meals on Wheels and other types of community food sharing).
B.3	Prioritise prevention of food waste by redirecting food for human consumption ahead of lower-value outlets such as animal feed, industrial uses (rendering or biorefining), anaerobic digestion, composting, or disposal.

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References

Agricultural and Food Supply Chain Act 2023, Act No. 19/2023, Irish Statute Book. Available at: <https://www.irishstatutebook.ie/eli/2023/act/19/enacted/en/> (accessed 20 November 2025).

Agri-Food Regulator *Unfair Trading Practices* <https://www.agrifoodregulator.ie/whatwedo/enforcingunfairtradinglaw/unfairtradingpracticesutps/> (accessed 25 May 2026).

Attard, J. and O'Connor, T. (2022) *Food Loss and Waste from Farming, Fishing and Aquaculture in Ireland (2019-RE-DS-15)*. EPA Research Report 410. Johnstown Castle, Co. Wexford: Environmental Protection Agency. Available at: https://www.epa.ie/publications/research/waste/Research_Report_410.pdf (accessed on: 25 November 2025)

Central Statistics Office (CSO) (2024) *Farm structure* (Farm Structure Survey 2023). Statistical release, 17 December 2024. Available at: <https://www.cso.ie/en/releasesandpublications/ep/p-fss/farmstructuresurvey2023/farmstructure/> (accessed: 30 January 2026)

Department of Agriculture, Food and the Marine (2023) *National Strategy for Horticulture 2023-2027*. Dublin: Government of Ireland. Available at: <https://www.gov.ie/en/department-of-agriculture-food-and-the-marine/publications/national-strategy-horticulture-2023-to-2027/> (accessed on: 25 November 2025)

Department of Agriculture, Food and the Marine (2025) *Annual Review and Outlook for Agriculture, Food and the Marine 2024–2025*. Dublin: Economics and Planning Division, Department of Agriculture, Food and the Marine. Available at: https://assets.gov.ie/static/documents/1376a3ff/ARO_2024-2025_Full_Text.pdf (accessed: 30 January 2026).

Department of Agriculture, Food and the Marine (n.d.) *National Strategy for Horticulture 2023–2027: Mid Term Review* (draft report). Available at: https://assets.gov.ie/static/documents/adfc069a/National_Strategy_for_Horticulture_mid_term_review_final_1.pdf (accessed: 30 January 2026).

Department of Climate, Energy and the Environment (2023) *National Food Waste Prevention Roadmap 2023-2025*. Dublin: Government of Ireland. Available at: <https://assets.gov.ie/static/documents/national-food-waste-prevention-roadmap-2023-2025.pdf> (accessed on: 25 November 2025)

Report 5 - Farm-Level Food Loss

Department of Health (2013) *Healthy Ireland - A Framework for Improved Health and Wellbeing 2013-2025*. Dublin: Government of Ireland. Available at: <https://www.hse.ie/eng/services/publications/corporate/hienglish.pdf> (accessed on: 25 November 2025)

Department of Health (2021) *Healthy Ireland Strategic Action Plan 2021-2025*. Dublin: Government of Ireland. Available at: <https://www.gov.ie/en/healthy-ireland/publications/healthy-ireland-strategic-action-plan-2021-2025/> (accessed on: 25 November 2025)

Department of Social Protection (2020) *Roadmap for Social Inclusion 2020-2025*. Dublin: Government of Ireland. Available at: <https://www.gov.ie/en/departments-of-social-protection/publications/roadmap-for-social-inclusion-2020-2025/> (accessed on: 25 November 2025)

ECR Retail Loss (2020) *Contractual terms for reducing food waste*. Research paper. Published 19 August 2020. Available at: <https://ecrloss.com/research-paper/contractual-terms-for-reducing-food-waste/> (accessed: 30 January 2026)

End Food Waste Australia (2024) THE HORTICULTURE SECTOR ACTION PLAN FOR FOOD WASTE REDUCTION 2024 Technical Report (accessed on: 23 April 2026)

European Commission Joint Research Centre (2024) *Food Use and Waste Hierarchy*. Brussels: European Commission JRC. Available at: <https://data.europa.eu/doi/10.2760/684291> (accessed on: 25 November 2025)

European Commission press release *Revised Waste Framework Directive enters into force to boost circularity of textile sector and slash food waste*. https://environment.ec.europa.eu/news/revised-waste-framework-directive-enters-force-2025-10-16_en (Accessed on: 25 May 2026)

European Food Banks Federation (2021) *From Farm to Food Bank: Reimbursement of Farmers' Costs to Redistribute Surplus Food - Proposal for the Common Agricultural Policy*. Brussels: FEBA (Appendix 9).

European Union (2008) Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives (Waste Framework Directive), as amended.

European Union (2017) Commission Delegated Regulation (EU) 2017/891 and Commission Implementing Regulation (EU) 2017/892, fruit and vegetables and processed fruit and vegetables sectors.

Report 5 - Farm-Level Food Loss

FareShare (2021) *Defra Food Waste Fund: Review of FareShare's 2019 Grant for increasing surplus food redistribution through overcoming financial barriers*. Report/PDF. Available at: <https://fareshare.org.uk/wp-content/uploads/2021/01/DEFRA-Food-Waste-Fund-Report.pdf> (accessed: 30 January 2026)

FareShare - The Felix Project (2025) *Including Support for Food Redistribution in Farming Incentives an opportunity to deliver on economic, environmental, health and social priorities*. Available at: <https://thefelixproject.org/news/food-sector-urges-government-double-food-redistribution> (accessed: 17 April 2026)

Fox, S., Kenny, O., Noci, F. and Dermiki, M. (2023) 'A Pilot Study on Industry Stakeholders' Views towards Revalorization of Surplus Material from the Fruit and Vegetable Sector as a Way to Reduce Food Waste', *Sustainability*, 15(23), 16147. Available at: <https://www.mdpi.com/2071-1050/15/23/16147> (accessed on: 28 November 2025).

Government of Ireland (2025) *Programme for Government: Securing Ireland's Future*. Dublin: Government of Ireland. Available at: <https://www.gov.ie/en/department-of-the-taoiseach/publications/programme-for-government-2025-securing-irelands-future/> (accessed on: 25 November 2025)

Healthy Ireland Survey 2024, updated 20 October 2025
<https://www.gov.ie/en/healthy-ireland/publications/healthy-ireland-survey-2024/>

Horticulture Industry Forum National Horticulture Strategy Mid Term Review, November 2025
<https://www.bordbia.ie/contentassets/739075826e9b4abcb978e114c2fe9446/national-strategy-for-horticulture-mid-term-review-draft.pdf>

Hurley, M., O'Connor, T., Attard, J., Snowling, N. and Curtin, B. (2023) *FoodCloud Apple Gleaning Report*. Circular Bioeconomy Research Group, Munster Technological University and FoodCloud. (Appendix 5).

King, R. and Webster, J. (2023) *Designing and costing a Sustainable Farming Incentive (SFI) standard for surplus food*. Version 4. Report produced by The Andersons Centre for FareShare, December. Available at: <https://fareshare.org.uk/wp-content/uploads/2024/05/FareShare-Food-SFI.pdf> (accessed: 30 January 2026).

McGarry, M. (2025) 'The stories behind Gleaning Sunday and Irish harvest customs', *RTE Brainstorm*, 17 August. Available at: <https://www.rte.ie/brainstorm/2025/0817/1241763-irish-harvest-customs-rituals->

Report 5 - Farm-Level Food Loss

[traditions-gleaning-sunday-st-bartholomew-august-24th/](#) (accessed on: 24 November 2025).

MTU and FoodCloud (2022) Surplus Food Redistribution - An Opportunity to Reduce Farm-level Food Waste. Munster Technological University and FoodCloud, funded by the Department of Agriculture, Food and the Marine and Tesco Ireland (Appendix 2).

O'Connor, T., Kleemann, R. and Attard, J. (2022) 'Vulnerable vegetables and efficient fishers: A study of primary production food losses and waste in Ireland', *Journal of Environmental Management*, 307, 114498. Available at: <https://doi.org/10.1016/j.jenvman.2022.114498> (accessed on: 25 November 2025)

Power, J. (2025) Recommendations for an Agricultural Surplus Redistribution Programme in Ireland. Commissioned by FoodCloud. (Appendix 7).

RETAIN Circular Bioeconomy Research Group *RETAIN - Waste Reduction Initiatives for Sustainable Primary Food Production*. Munster Technological University. Available at: <https://circbio.ie/projects/national/retain-project/> (accessed on: 28 November 2025).

REFRESH (2019) *Regulating the role of Unfair Trading Practices in food waste generation*. REFRESH Policy Brief, March 2019. EU Horizon 2020 REFRESH project. Available at: https://eu-refresh.org/sites/default/files/REFRESH%20Policy%20Brief%20on%20UTPs_2019_FINAL.pdf (accessed on: 26 November 2025).

ROSETTA Project (n.d.) *Vegetables of Gold: Valorising Surplus Fruit and Vegetables in Ireland*. ROSETTA Project. Available at: <https://rosetta-project.eu/ireland/> (accessed on: 25 November 2025)

Teagasc Horticulture Crop Input Prices 2024 and 2025. Available at: <https://teagasc.ie/wp-content/uploads/2025/05/Horticulture-Crop-Input-Prices-2024.pdf> and <https://teagasc.ie/wp-content/uploads/media/website/publications/2025/Horticulture-Crop-Input-Prices-2025.pdf> (accessed: 16 April 2026)

US Department of Agriculture, Food and Nutrition Service (2026) *The Emergency Food Assistance Program: Farm to Food Bank Project Grants*. Page updated 9 January 2026. Available at: <https://www.fns.usda.gov/tefap/farm-to-food-bank-project-grants> (accessed: 30 January 2026)

WWF (n.d.) Global Farm Loss Tool. World Wide Fund for Nature. Available at: <https://www.globalfarmlosstool.org/> (accessed on: 25 November 2025)

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Appendices

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Appendix 1 - Application of Andersons Centre approach to Irish market

The Andersons Centre completed a report for FareShare UK to cost a surplus redistribution scheme⁵⁵. FoodCloud has applied that analysis to the Irish market to estimate quantities available of 13 fruit and vegetables (apples are excluded as, other than gleaned apples which are sent for juicing, FoodCloud has found very little surplus apples available in Ireland as they are used for juicing or cider production).

Crop	Estimated annual Irish production ('000 tonnes) ⁵⁶	Potential volume from Supply and Demand imbalance ('000 tonnes)	Potential volume from out of specification ('000 tonnes)	Total potential volume for redistribution ('000 tonnes)
Potatoes	368	3.46	8.74	12.2
Carrots	47	0.62	1.53	2.15
Parsnips	6	0.08	0.2	0.27
Onions	3.5	0.04	0.07	0.11
Leeks	2.5	0.04	0.05	0.09
Broccoli + Cauliflower	8.4	0.2	0.14	0.34
Cabbage	24	0.58	0.29	0.87
Swede	22	0.53	0.26	0.79
Lettuce	6	0.18	0.12	0.3
Tomatoes	3.9	0.08	0.13	0.21
Strawberries	8	0.32	0.4	0.72
Mushrooms	70	1.42	1.82	3.24
Total				21.3

⁵⁵ <https://fareshare.org.uk/wp-content/uploads/2024/05/FareShare-Food-SFI.pdf>

⁵⁶ CSO 2024 Irish potato production <https://www.cso.ie/en/releasesandpublications/ep/p-aypc/areayieldandproductionofcrops2024/>. For other vegetables Teagasc, Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_crops#Vegetables or 2020 data from O'Connor et al (2022)

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Appendix 2 - Surplus Food Redistribution - An Opportunity to Reduce farm-level Food Waste

Munster Technological University (Munster Technological University (MTU) and FoodCloud, funded by the Department of Agriculture, Food and the Marine and with further financial support from Tesco Ireland (March 2022).

Surplus Food Redistribution - An Opportunity to Reduce Farm Level Food Waste



This report was produced by Dr. Jennifer Attard and Dr. Tracey O'Connor of Munster Technological University (MTU) and FoodCloud, funded by the Department of Agriculture, Food and the Marine and with further financial support from Tesco Ireland. (March, 2022).

Executive Summary

Context

The need for intervention to reduce food loss and waste (FLW) is widely recognized, as indicated by the United Nations' Sustainable Development Goal 12 (2015), and the European Union's inclusion of food waste in the Waste Framework Directive (2020). The goal to halve food waste by 2030 has also been included in Ireland's Climate Action Plan (Government of Ireland, 2019).

In Ireland, over one million tonnes of food are wasted annually. Within the food production stage 189,485 tonnes of food is lost or wasted before the farm gate or at harbours (O'Connor, Kleemann & Attard, 2022). Vegetable production accounts for the main source of FLW at the farm and fishery level, with approximately 122,395 tonnes per annum. The main reasons for loss and waste were found to be related to produce not meeting retail specifications, and seasonal lack of consumer demand. No research has been undertaken as of yet to identify the extent and nature of farm surplus available for redistribution, and the current pathways for disposing of farm surplus.

Purpose

The core objective of this study, which was funded by the Department of Food, Agriculture and the Marine and supported by Tesco with further funding and introductions to growers within their supply chain, was to investigate the potential for increasing redistribution of surplus food from the Irish horticulture sector to the charity sector, thereby reducing food waste and addressing food insecurity in Ireland.

This project aimed to develop knowledge about how a fund to compensate the donation of surplus produce to food redistribution organisations could be implemented in Ireland, including the barriers to surplus redistribution and acceptable initiatives for farmers that could support redistribution of surplus food. This study was carried out using 1) desk-based research involving interviews with, and surveys of, farmers about their food waste and donation experience and 2) a pilot study of a compensated donation surplus donation fund. A range of growers supplying different markets and different retailers participated in the research. Findings identified in this report are considered to be sector-wide rather than attributable to any single retailer.

Key results of the desk based research:

- Almost four out of five farmers have edible surplus (77%).
- One in four farmers experienced losses between 20-50% of their potential crop.
- Of the losses reported by farmers, two main causes of loss were identified - farm management and environment-related losses, e.g. weather-related damage, and market and customer-related losses, e.g. retail specifications or an unexpected decline in demand.
- Farmers managed surplus in multiple ways, depending on the type of crop, and access to a market. Pathways without a direct financial return included leaving food unharvested (52% of farmers), use as compost or spread directly on fields (39% of farmers), donation of food (6% of farmers), or paying to have it removed for anaerobic digestion (3% of farmers).

- For those that donated surplus, they did so through “gleaning” of unharvested food by volunteers (3% of farmers) or donation of food that has passed through the packhouse but cannot be sold (6% of farmers).
- The main challenges for farmers related to donating food included: logistics (48%), time (39%), process management (29%), storage (10%), and packaging (10%). A number of farmers (32%) did not face or anticipate facing any challenge.

Key results of the pilot study:

- Five growers participated in the pilot which resulted in the redistribution of 30,647kg of produce that would otherwise have remained unharvested or sent for animal feed.
- The approximate greenhouse gas emissions avoided was 98,070kgs of CO₂-eq.
- 125 different community organisations were provided with produce, with an estimated retail value of €29,910, over the five month pilot period. That is the equivalent of approximately 72,969 meals.
- The five growers recovered €13,621 in costs by redistributing this produce rather than wasting it.
- There was a significant difference between the average price that growers received for processing (€150 per tonne) and the average cost the growers provided for provision of surplus to FoodCloud as part of the pilot. This indicates that there is such a low floor price for processing/animal feed that any scheme that would fund the growers cost to redistribute to community groups would disrupt the processor and animal feed markets and out-compete those existing buyers, however these markets are not financially viable for growers in any case.

Key recommendations

It is recommended that this pilot project be scaled up. Over a three year period this project could rescue 993 tonnes of surplus food that arises within the horticulture sector. This would require funding of up to €375,000 per annum of which €166,000 per annum would be provided back to participating growers. It is obvious that, even at scale, this project on its own will not address the overall problem of reducing edible farm level surplus. Therefore a number of further areas need to be explored;

- More **collaboration between farmers and retail actors** to develop better systems to manage retail specifications and innovate in this space, e.g. broadening retail specifications, marketing a broader range of vegetables and more communication with consumers about their influence e.g. buying seasonal produce, and trying produce that is outside specifications.
- Investment in the horticulture sector to enable growers to **develop on-site processing technologies** to add value to produce that might otherwise have low returns or become waste.
- Creation of a financially sustainable **marketplace for grade II produce**, by way of example, a social enterprise in Holland, [Instock](#) has created a marketplace for producers to connect directly with the hospitality sector to trade surplus food. The viability of this solution in Ireland would need to be investigated further.
- **Investment in circular economy organisations** working in the area of food redistribution (FoodCloud) or valorisation (e.g. Cream of the Crop) to promote innovation and create new markets that can take large volumes of farm level edible surplus.

- **Stronger coordination between fruit and vegetable farmers** on this topic, including through farmer co-operatives and farmer representation organisations ,e.g. the Irish Farmers Association, could strengthen farmer self-advocacy capacity, ensuring a better chance of success with engaging other food network actors, e.g. processors, retail, and consumers.

1. Introduction

Approximately one third of food produced globally is wasted. This waste occurs despite the availability of advanced food storage and preservation technologies, and the extent of global food poverty, with an estimated 2.4 billion people experiencing food insecurity in 2020, equivalent to one third of the world's population (FAO *et al.* 2021). In Ireland, 8% of the population experienced food poverty in 2018, the most recent year on record (CSO, 2019). If a greater portion of world food production were utilised through waste prevention, and distributed appropriately, it would be enough to address food global hunger and malnourishment (Facchini *et al.* 2018).

When food is wasted, the resources to produce, process, and distribute that food, are also wasted. At farm-level, this includes land, water, labour, and other inputs, such as plant nutrition and pest control inputs. The degradation of food waste can also contribute to greenhouse gas emissions if not managed appropriately. Considering all of these sources of greenhouse gas emissions, food loss and waste contributes 8-10% of global greenhouse gas emissions (Environmental Protection Agency 2021). Food waste touches on many issues on the sustainable development agenda, including hunger and deprivation, environmental resource management, and sustainable production and consumption systems. For example, the need to reduce food waste is specifically addressed by Goal 12, Target 12.3 of the United Nations' Sustainable Development Goals (2015), which describes the need to reduce food losses along the food supply chain and halve food waste at the consumer stage by 2030. In addition to this global goal, the European Union has included food waste in the Waste Framework Directive, establishing a framework for monitoring and reducing food waste, with the aim to halve food waste by 2030. Member States must quantify and report food waste data to the European Commission from the year 2022 onwards (European Commission 2020). The European Commission (2020) defines food loss as "a loss in potential food produced prior to the harvest of crops or animal products, including meat", while food waste is "the loss of harvested food, before it can pass into the next stage of the supply chain". This is referred to collectively in this document as food loss and waste (FLW).

The goal to halve food waste by 2030 has also been included in Ireland's Climate Action Plan (Government of Ireland 2019). The Irish government has also expressed ambition to reduce FLW in other agri-food and environmental policies, e.g. Food Vision 2030, AgClimatise 2020, and the Waste Action Plan for a Circular Economy (Department of Agriculture Food and the Marine 2021; 2020; Department of the Environment 2021). In Ireland, over one million tonnes of food are wasted annually, with most of this taking place in the commercial and manufacturing sectors. Within the food production stage 70,415 tonnes of food produced is wasted before the farm gate or at harbours, while a further 119,093 tonnes are lost (O'Connor, Kleemann & Attard, 2022). Vegetable production accounts for the

main source of farm level FLW, with approximately 122,398 tonnes lost or wasted before the farm gate per annum.

1.1. Irish fruit and vegetable production context

There are approximately 135,000 farms in Ireland, of which less than 1% of Irish farms are involved in fruit and vegetable production (CSO 2021a). Estimates of the number of fruit and vegetable producers in Ireland varies, ranging from approximately 200 farms, to approximately 260 fruit and vegetable producers registered with Bord Bia (2021), and 370 Irish farms recorded by Eurostat (2022a) as producing vegetables and fruit. The seasonality of fruit and vegetable production in Ireland is influenced by the cool temperate oceanic climate, and geographic location between 51-55°N of the equator, which is responsible for strong seasonal variation in day-length and light exposure. Despite this, the majority (84%) of edible horticulture production is outdoor, exposing crops to weather-related risks more than indoor counterparts (Eurostat 2022a). The potato accounts for the greatest portion of horticultural output, with 270,000 tonnes produced in 2020 (CSO 2021b). Other common field vegetables include brassicas (cabbage, broccoli, cauliflower, brussels sprout, kale, swede, turnip), alliums (onion, leek, scallions, shallots, garlic), and umbellifers (carrot, parsnip, celery, parsley, fennel) (Bord Bia 2021). Other outdoor crops include beetroot, spinach, cucumber, courgette, pumpkin, and rhubarb. Crops are also produced under cover, or a combination of covered and outdoor production, predominantly lettuces and tomato (Bord Bia 2021). Mushroom production is a substantial component of Irish vegetable production, producing 69,000 tonnes of mushrooms in 2020 (CSO 2021b). Most mushroom production is of *Agaricus bisporus* (includes button, chestnut, and portobello mushrooms), and takes place under cover. Irish fruit production comprises “top fruit”, dominated by apple production, but also including plums and cherries, and “soft fruit”, grown both under cover and outdoors, and dominated by strawberry production but also including raspberries, blackberries, blueberries, gooseberries, and currants (Bord Bia 2021).

Irish fruit and vegetable growers experience low bargaining power within the value chain, typically being price-takers, not price-makers (IFA 2022; O'Connor, Kleemann & Attard 2022). Declining prices offered by retailers to producers results in produce that is not economical to harvest, or cannot be sold, in the short-term, as reported by farmers in this study. Longer-term, this “price compression” has resulted in long-term erosion of producer profits and viability of farms, with farms exiting the sector in response (IFA, 2022). O'Connor *et al.* (2022) reported that the main reason for FLW in the Irish horticulture sector is producers being unable to sell harvested produce, due to produce not meeting retail specifications, and seasonal lack of consumer demand (31%). The second-most prevalent cause of FLW is produce being excessively difficult to harvest, due to losses from harvest machinery or root vegetables being too deep in the soil to harvest (28%). Additional causes of horticulture FLW are pests and disease (17%), respiration and moisture losses (in storage) (11%), environmental conditions and weather-related disruptions, e.g. flooding (8%), and pre-sale processing losses, i.e. during handling in the packhouse, including trimming of vegetables to meet specifications, e.g. mushroom stalks (4%) (O'Connor, Kleemann & Attard 2022).

Retail specifications are evidently a substantial source of surplus, which typically becomes FLW. In the European Union there are established minimum specification standards for fruit

and vegetables generally, and some specific standards for particular types of fruit and vegetable, e.g. apples (European Commission 2011). These prescribe food quality (e.g. free of pests), size (e.g. diameter, weight), and aesthetic standards (e.g. the extent of red colouring on apples). The specific standards establish three grades of quality: Extra (highest quality), Grade I, and Grade II. The crops grown in Ireland to which these specifications apply are: apple, endive, lettuce, sweet pepper, strawberry, and tomato.

Other crops are subject to the general specification standards, which require them to be fit for transport and human consumption, free of pests, pest damage to the flesh, foreign matter, abnormal external moisture, and foreign smells or taste (European Commission 2011). The general standards do not set out different grades for produce. However, retailers have established their own criteria for other types of produce. Some criteria are easy for producers to assess prior to delivery, e.g. size, shape, colour, and to some extent superficial blemishes or damage. Produce is typically reviewed by retailers following delivery, and a portion may be rejected due to falling outside the specifications, especially aesthetic specifications regarding blemishes and minor superficial damage. Farmers may purposefully produce surplus to ensure they do not under-supply retailers with whom they are under contract to supply a certain quantity and quality, e.g. if adverse weather conditions occur (Beausang, Hall, and Toma 2017). However, this surplus edible food can be difficult to sell under normal environmental conditions (Beausang, Hall, and Toma 2017).

For edible produce which is assessed by producers as being outside of retail criteria, producers can find alternative non-waste destinations, e.g. food donations and food processors (non-retail human consumption), and animal feed, composting or industrial processing (agricultural/industrial markets). The European Union standards can be suspended for regional products, traditional foods, and direct sales to consumers by farmers/at farmers' markets (European Commission, 2011). Food which is to be donated and used in processing as trimmed or sliced "ready-to-eat"/"kitchen-ready" food must be fit for human consumption, but is also not subject to the quality specifications established by the European Union or individual retailers. Food to be used in industrial processing, e.g. starch production, or as animal feed or compost are also not subject to the quality specifications described above. Both the non-retail human consumption and agricultural/industrial markets typically offer a lower financial return than sale to retailers/wholesalers, and may not be lucrative enough to merit harvesting, packing and/or transporting produce. Food surplus which could enter these markets is therefore still wasted under poor market conditions.

1.2 Intervention

The need for intervention to reduce FLW is widely recognized, by actors at different stages of the food value chain. These interventions are described below.

1.2.1 Prevention, redistribution and valorisation options

Due to the social, economic, and environmental implications of FLW, disposal of food waste without any further recovery of value should be avoided. Unlike other forms of material waste, reuse or recycling of food cannot be reused or recycled for human consumption post-disposal. Therefore, FLW prevention, including pre-disposal food rescue, is preferred (Papargyropoulou *et al.*, 2014). Edible food which is at risk of disposal, also known as "food

surplus” or “edible surplus”, can be recovered and redistributed, for example via the charity sector, to support people experiencing food insecurity, malnutrition and social exclusion (Facchini *et al.* 2018). If neither prevention or redistribution is possible, value can be recovered from food waste through valorisation as animal feed, and conversion into energy through anaerobic digestion and biofertilizers through composting.

These options involve different value chain actors, including government and regulatory bodies, consumers, retailers, processors, food redistribution organisations, and producers, and are presented in order of preference, from a social, economic, and environmental perspective, in the “Food Waste Hierarchy” (see Fig. 1), which applies the Waste Hierarchy described in the European Union Waste Framework Directive to the specific context of food waste (European Commission Joint Research Centre 2020).

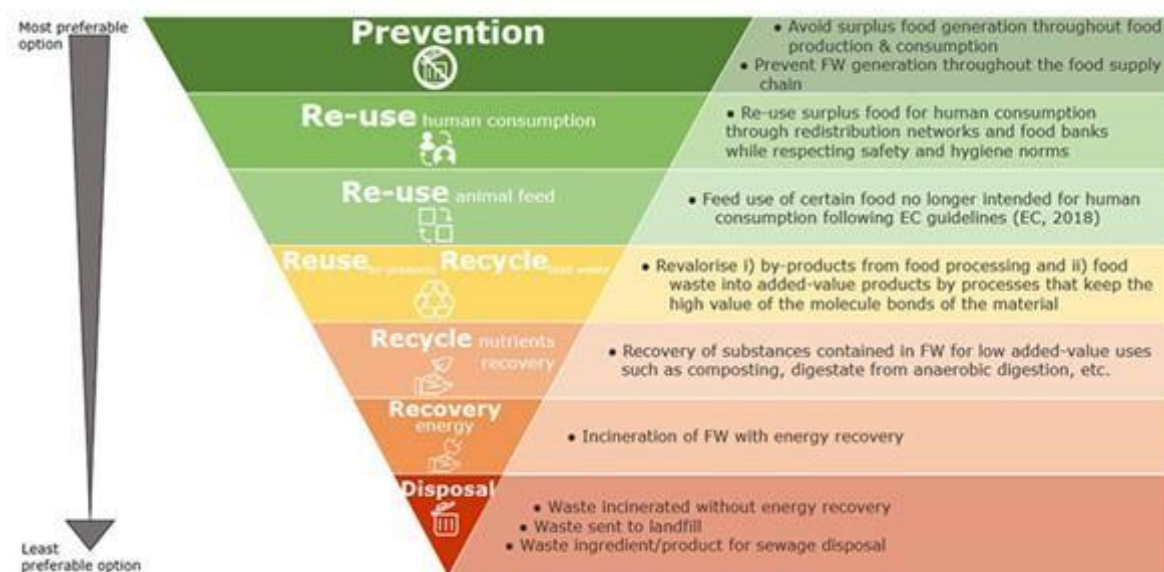


Figure 1. Food waste hierarchy (European Commission Joint Research Centre 2020).

Government intervention typically involves restriction of industry practices that result in food waste, e.g. landfill food waste bans, prohibition of unfair trading practices, and restricting multi-buy offers in retail outlets, e.g. 3-for-2 offers (HLPE 2014; FAO 2019). Regulations which address value chain trading practices and strengthen the bargaining power of producers can also reduce food waste, e.g. regulation of unfair trading practices such as EU Directive No. 2019/633 on Unfair Trading Practices. Consumer intervention involves encouraging consumers to reduce food waste, for example through good food purchasing and storage practices. These include information and education initiatives, e.g. advertising campaigns, seasonal shopping guides, and online information tools, but also behavioural nudges, e.g. smaller food packages to avoid waste by smaller size households (HLPE 2014).

Retailer intervention typically involves adding value to food through retail innovation, including collaboration with processors, such as incorporating low-value produce in processed food, e.g. vegetable meatballs; marketing produce that is outside specifications e.g. “mini” vegetables and “odd” or “ugly” misshapen vegetables (van Giesen and de Hooge

2019); and discounting produce at the end of its shelf-life to reclaim some value, e.g. retailer's "yellow-sticker" discounted produce sections; Albert Heijn's "Waste-Me-Not" bags (2021); and the "Magic Bag" of Too Good To Go (2022). Processor interventions include adding value to food by creating food ingredients and extending shelf-life, e.g. gelato (Cream of the Crop 2022), jams (Rubies in the Rubble 2021), and baked goods (SUNT Food 2022). Some Irish farms have also invested in on-site processing technology to add value to their produce, e.g. prepared meals, and food grade potato starch. Producer-focused interventions are described in greater detail in section 1.2.2.

Food redistribution interventions have the dual purpose of reducing food waste and increasing food access for people experiencing food insecurity. These can be business-to-consumer or business-to-business interventions, e.g. food-sharing platforms such as Olio. More frequently, redistribution from other supply chain actors to consumers is mediated by social enterprises and charities, e.g. food redistribution organisations such as food banks (Global FoodBanking Network 2022), FoodCloud (2022), and FareShare (UK) (2022), and charities with a food service, such as Penny Dinners (2021). Interventions to redistribute surplus food to people in this way include surplus supermarkets and community "food pantries" or fridges where people can select food for free, e.g. OzHarvest Market (2022), Community Shop (2022), and Second Harvest (2022). These initiatives also include surplus kitchens and community-spaces offering free or low-cost meals prepared from surplus food, e.g. FoodBank Australia (2020), Instock (2022), and Northern Soul Kitchen (2022).

1.2.2. Farm-level redistribution

At the production stage, there are three main types of food waste intervention that can support redistribution of food surplus: a) "traditional", uncompensated donation of food surplus to food redistribution organisations and charities; b) donation of food surplus to food redistribution organisations and charities, with compensation of part or all of the grower's costs of donation; and c) food redistribution organisations and charities enter the "market" for produce to re-direct food surplus from lower value uses to consumers. The latter two options encourage greater donation of food at farm-level, thereby addressing FLW issues at the beginning of the food supply chain and increasing the proportion of fresh, minimally processed, and nutrient-rich produce that is available to charities with food programmes.

1.2.2.1 Traditional donation

The concept of food donation, whereby farmers donate food without receiving direct compensation, has existed for a long time, and still contributes to food redistribution, including in Ireland, e.g. to food redistribution organisations such as FoodCloud (2022), or charities, such as Penny Dinners (2021). However there is also innovation within this type of food waste intervention. One type of innovation is "gleaning", whereby volunteers harvest unharvested produce, for use by charities (Woolley, Martin, and Charlesworth 2015), e.g. as implemented in Ireland by FoodCloud's gleaning projects (2020).

1.2.2.2 Compensated donation

There are two main types of compensation for donations of surplus by farmers, compensation via tax deductions for the donation made, and direct compensation, e.g. for

the costs of production. In a number of countries, agricultural produce is included in the eligibility criteria for tax-deductible donations or is rewarded with tax credits for producers, e.g. Canada, Colombia, France, Spain, and the US (Vittuari et al. 2016; Kinach, Parizeau, and Fraser 2020; ABACO 2020; Feeding America 2017). Food redistribution organisations are leveraging this policy to collect surplus from farmers directly. In Colombia, the “Recovery of Agricultural Surpluses” (REAGRO) programme of the NGO ABACO aggregates farmers’ surplus for redistribution through the food bank network, with farmers receiving compensation through tax deductions for their donations and the logistics organisation and costs managed by ABACO (2020).

Producer co-operatives can also play a role in enabling tax-deductible producer surplus donations to food redistribution organisations. The NGO Feeding America has established six “produce cooperatives” across the United States of America to connect with farmers that have surplus, in order to increase the amount of fresh produce available to charities and communities (Feeding America 2017). The cooperatives procure and process large volumes of tax-deductible produce donations, and redistribute it in more manageable quantities based on the needs of their local community. In addition to eligibility for tax deductions on donated produce, producers receive payment per tonne of donated produce. The “Charitable Donation Scheme” enables tax-deductible charitable donations of a monetary nature in Ireland, but unfortunately material goods, such as agricultural products, are not eligible for a tax deduction or tax credit (Revenue 2021). The existing donations policy could be adapted to recognise the value of “benefit-in-kind” donations, e.g. grade II food surplus, valued by volume donated.

Direct compensation programmes pay farmers an agreed level of compensation for donation of food surplus to redistribution organizations. For example, in 2019, the UK-based food redistribution organisation FareShare launched a £3 million “Surplus with Purpose” fund with support from the UK Department for Environment, Food and Rural Affairs (FareShare 2022). This fund covers the costs of food recovery for farmers, as well as other food supply chain actors, including costs of production, storage and transport, up to a maximum of £50,000.

1.2.2.3 Market-based approach

The market-based approach deviates from the donation-based models described above, in that food redistribution organisations enter the conventional purchasing market, purchasing food that meets their needs and specifications at an appropriate price for the quality offered, which may be different to that accepted by retailers, e.g. accepting grade II produce at a price which reflects the challenge of selling this produce through other channels. This approach was taken in the US as part of the “Coronavirus Food Assistance” programme from 2020-2021. The US Department of Agriculture “Farmers to Families Food Box” programme provided funds to food redistribution organisations at regional and local levels, such as City Harvest NYC (2022), to purchase food directly from farmers and other food supply chain organisations (USDA 2021). The purchased food was packed by redistribution organisations into family-sized boxes, for delivery to food banks and other charities providing a food support service. This approach has not been attempted by Irish food redistribution organisations yet, although some organisations providing a low-cost meals service in Ireland, e.g. Meals on Wheels, buy produce directly from farmers on demand and according to their own specifications (personal communication, 2021).

1.3 Aims and objectives of this research project

Previous research in Ireland has identified the proportion of fruit and vegetables that are lost or wasted before the farm gate. However, no research has been undertaken as of yet to identify the extent and nature of farm surplus available for redistribution, and the current pathways for disposing of farm surplus. This study aims to investigate the potential for increasing redistribution of surplus food from the Irish horticulture sector to the charity sector, thereby reducing food waste and addressing food insecurity in Ireland. In other countries, compensated donation of food has been implemented to encourage use of surplus produce as food, e.g. Fareshare in the UK. Given the small scale of the Irish horticulture sector, it is unclear how this approach might work in Ireland, despite the high volume of FLW relative to other food production activities in Ireland. This project also aims to develop knowledge about how a fund to compensate for the donation of surplus produce to food redistribution organisations could be implemented in Ireland, including the barriers to surplus redistribution and acceptable initiatives for farmers that could support redistribution of surplus food.

In order to achieve the aims described above, the study will a) extend current knowledge of horticulture waste and food donation experience among farmers, including how to reduce barriers to surplus redistribution; and b) examine the viability of a compensated surplus donation fund in Ireland.

2. Methodology

This study was funded by the Department of Food, Agriculture and the Marine and also supported by Tesco with further funding and introductions to growers within their supply chain. The study was carried out using two principal methods: 1) desk-based research involving interviews with, and surveys of, farmers about their food waste and donation experience (Section 2.1); and 2) a pilot study of a compensated donation surplus donation fund (Section 2.2).

2.1. Desk-based research

Existing research was examined to assess the extent of farm-level food waste and potential for redistribution, e.g. of edible farm-level food waste. A topic list for interviews, and an online survey addressing the same topics, were developed to explore farmers' experience of food waste, surplus food, and food donation and redistribution. The topics and related questions were developed on the basis of the literature review carried out at the start of the study, and the authors' experience in food redistribution (FoodCloud) and farm-level food waste research (CircBio Research Group at MTU).

Farmers whose contact information was publicly available or already known, e.g. existing FoodCloud partners, were contacted to participate in in-depth interviews of approximately 60 minutes, exploring the food waste issues on their farm and how food redistribution might work for them. Based on the initial scoping exercise, a shortlist was compiled of "waste-vulnerable" farm types that were more likely to experience waste due to the produce they grow, such as potatoes and brassicas (O'Connor, Kleemann, and Attard 2022). Sixteen farmers of waste-vulnerable farm types were prioritised for interview. Farmers whose farms were not of the shortlisted types were also contacted, to ensure that a range of viewpoints

were captured, e.g. mixed vegetable farms (n = 11), covered crop specialists, e.g. tomato growers (n = 3), and soft fruit farms (n = 4).

The online survey was circulated widely among known fruit and vegetable farmers (n = 34), and among fruit and vegetable wholesale organisations (n = 10), Irish farming and environmental organisations, e.g. Irish Farmers Association (n = 14), Irish farming media, e.g. Agriland, Horticulture Connected (n = 5), and food retail organisations (n = 4), with an invitation for the survey to be shared in their networks to ensure a wide range of fruit and vegetable farmers were invited to participate.

2.2. Pilot study

The pilot study part of this project was inspired by the Surplus with Purpose Fund developed by UK Food Redistribution NGO, FareShare. FoodCloud worked with FareShare to understand how the fund was developed and executed, and FareShare provided guidance documentation which helped with the development of the pilot, including their final report to the British Department of Environment, Food and Rural Affairs on the Surplus with Purpose fund, cases studies of participating growers in the UK, a one-page outline of the fund for new participants and costing templates.

The pilot was promoted to farmers who took part in the survey and also via a press release that was issued in October 2021 and was featured in Horticulture Connected (2021) and Agriland (Commins, 2021), as well as across CircBio (MTU) and FoodCloud's social media channels. It was also promoted to growers through FoodCloud's existing network of food industry and retail partners and via CircBio's network. Tesco introduced FoodCloud to five of their Irish suppliers who would potentially be interested in the pilot. As a result, 15 growers expressed an interest in getting involved in the pilot, with five ultimately proceeding.

Once a farmer expressed interest in participating in the pilot, they entered into the process of defining the terms of their participation with FoodCloud, i.e. how and why surplus produce arises on their farm, how it could be made available to FoodCloud, what compensation would be required, etc. A proposed approach document was prepared and agreed on between the grower and FoodCloud before the pilot was initiated.

2.2.1. Participant Feedback

On completion of the pilot, each participating farmer took part in a feedback interview developed by CircBio, with two interviews taking place on the farms in question. Farm visits enabled the processes that had been implemented for food provision to take place to be observed, and the process by which food surplus was created at farm-level to be demonstrated, e.g. grading out in packhouses, or planting surplus to ensure supply. One wholesaler who facilitated pilot study participation (initial contact and drop-off/collection point for surplus produce) also participated in the interview process. Interviews typically lasted 45 minutes by phone or 1.5 hours where farm visits also take place. Interview notes were recorded on paper by the FoodCloud representative, while the interview structure was based on a feedback questionnaire.

3. Survey Results

Thirty-one farmers participated in the survey, 58% by phone or video call, 42% by online survey which was widely circulated, as described above in section 2.1.1. The 31 farmers represent 12% of the approximately 260 commercial fruit and vegetable farmers registered with Bord Bia (2021).

3.1 Farm characteristics

Farmers of all European Union farm size categories were represented (Eurostat, 2022b). Due to a lack of accessible national-level data regarding fruit and vegetable farms, it is not possible to assess whether the distribution of farm sizes found in this sample is similar to the national distribution of fruit and vegetable farms. However, comparing the data with the farm size distribution of Irish farms generally, farmers of very small (<2ha) farms are over-represented in this sample (29% compared to 2% nationally), as are farmers of large farms (≥ 100 ha) (26% compared to 4% nationally). Meanwhile, those of small (2-19ha) and medium (20-99ha) farms are under-represented (small: 10% compared to 42% nationally; medium: 23% compared to 53% nationally) (Eurostat, 2022b). A further 13% did not provide information about farm size. Two of the 31 farmers farm organically. The results regarding farm size indicate that more horticulture-focused data collection and research is required to appropriately represent Irish fruit and vegetable growers, as their characteristics, e.g. farm structure, differ from those of Irish farms generally.

Most farmers were vegetable producers (71%), while 23% were fruit growers and 10% were mushroom growers. The distribution of farm types is largely representative of the diversity of fruit and vegetable farmers registered with Bord Bia (2021), of which 75% were vegetable producers and 15% were mushroom-growers, but over-represents fruit-growers, which comprised 12% of farmers registered with Bord Bia (2021). The specific fruit and vegetables grown by participating farmers were diverse, giving good insight into FLW across many crop types. The vegetables produced by participating farmers are described in Fig. 2 below. Of the fruit growers, most were growers of soft fruit (71%), while 43% produced apples.

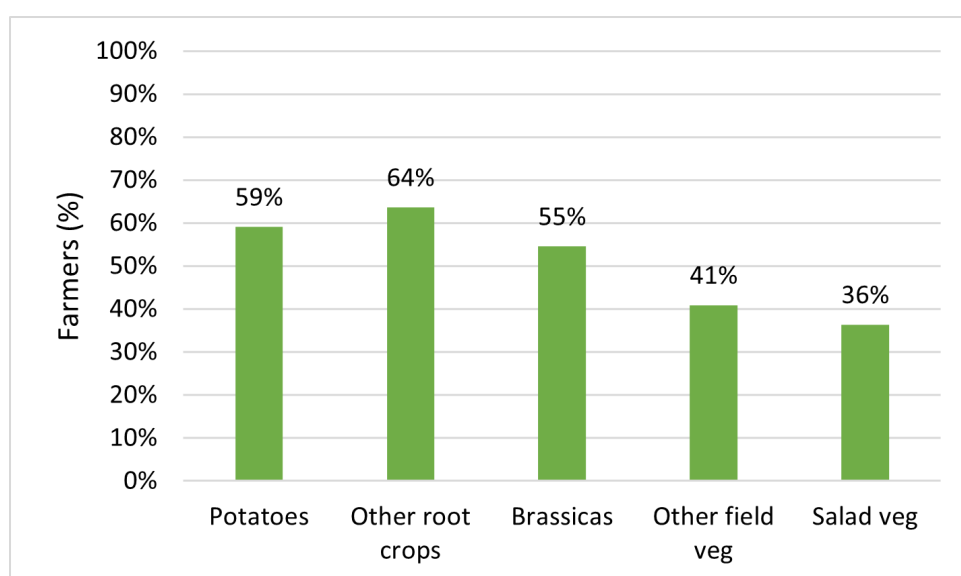


Figure 2. Types of vegetables produced by vegetable farmers participating in the survey (n = 22)

3.2 Crop losses

Most farmers (84%) provided an estimate of their crop losses, i.e. what they typically lose from the potential yield of crops sown. These data are described in Table 1. Losses at the pre-harvest stage were typically less than or equal to those at the post-harvest stage, indicating that there is a great opportunity to reduce losses by targeting post-harvest losses, e.g. packhouse losses. The proportion of field crops lost varied widely, with some growers experiencing low losses and others experiencing more than 20% losses for the same crops, e.g. potato. Losses of other crops, for example covered crops, were more consistent.

One in four farmers experienced losses between 20-50% of their potential crop. These included: large-scale specialist growers of broccoli, field vegetables (potato, root vegetables, e.g. carrot and swede) and salad vegetables, and small/medium-scale growers of mixed vegetables. Farmers experiencing a low proportion of losses (less than 10%) included fruit growers, mushroom growers, large-scale mixed vegetable farms and small-scale specialist growers, indicating that these farms are unlikely to have large quantities of surplus for redistribution to charities.

Table 1. Estimates of losses experienced by farmers (n = 31).

Proportion of crop typically lost	Nil	Negligible (<1%)	Low (1-9%)	Moderate (10-24%)	High (25-39%)	Very high (40-50%)
Proportion of farmers experiencing losses, by proportion of crop lost	3%	13%	19%	26%	13%	13%

3.2.1. Factors contributing to losses

Of the losses reported by farmers, three key stages during which losses take place were evident, illustrated in Fig. 3. These were the growing stage, harvest stage, and packhouse and sale stage. At each stage, losses occurred due to two main factors, environment/farm factors, e.g. pests and crop management, and market/customer factors, e.g. an unexpected decline in demand. This data indicates that farmers have capacity to manage much of the losses occurring at the growing stage, e.g. by modifying production practices and the crop environment, but currently have more limited capacity to manage losses at harvest stage and packhouse and sale stage through adaptation of farm practices or the physical environment. Conversely, while market actors, e.g. wholesalers, retailers, and consumers, have little influence on production stage losses, farmers perceive that they have a somewhat greater influence than the farmer or environmental influences on harvest stage losses, and have a substantial impact on packhouse and sale stage losses. Clearly, greater collaboration between farmers and retail actors, and more communication with consumers about their influence, e.g. buying seasonal produce, can enable farmers to reduce post-harvest waste, and farm-level FLW more generally.

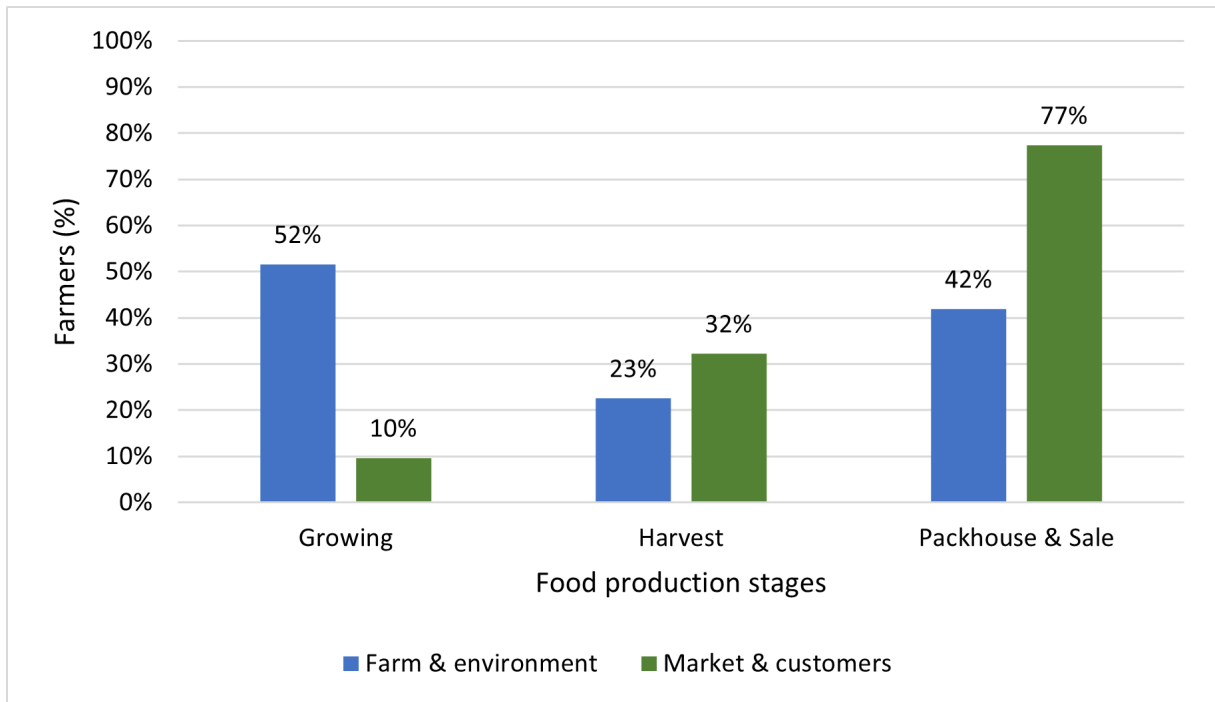


Figure 3. Farmers experiencing losses due to environment/farm factors and market/customer factors, across food production stages (n = 31).

3.3 Food surplus

Almost four out of five farmers have edible surplus (77%). Edible surplus occurred across most crop types. Those farms least likely to experience surplus were mushroom growers (two of three farmers reported not having edible surplus), and fruit growers, especially blackcurrant (no edible surplus).

3.3.1 Seasonality

In most crops, surplus occurs in the summer, with 52% of farms reporting a summer surplus, as described in Fig. 4. Spring was the “leanest” period for surplus, but nonetheless, 26% of farms reported Spring surplus.

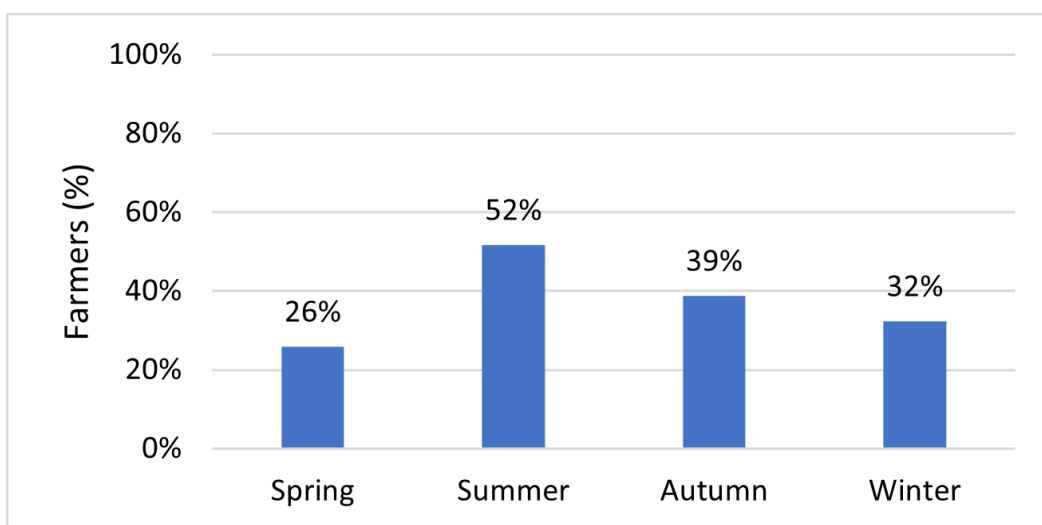


Figure 4. Seasons in which edible surplus arises, as reported by farmers (n = 31).

Edible surplus was experienced with some crops all year round, e.g. beetroot, broccoli, cabbage, carrot, cucumber, kale, salad leaves/lettuces, leeks, onion, parsnip, potato, pumpkin, and swede/turnip. These could be a reliable source of vegetables for charities, as some of these crops (potato and swede/turnip) also store well with collection windows of up to a few months. In addition to the crops with surplus all year round, some crops were more likely to have surplus during particular times of year. This information is described in Table 2, and is valuable for managing food collection and storage by food redistribution organisations and charities.

Table 2. Seasons in which surplus of certain crops are most likely to occur, by crop type.

Spring	Summer	Autumn	Winter
Carrots, onion, and potato	Beans, beetroot, brussels sprouts, broccoli, cabbage, cauliflower, kale, leek, salad leaves/lettuce, mushroom, onion, parsnip, potato, pumpkin, spinach, strawberry, swede/turnip, and sweetcorn	Apples, beans, broccoli, cabbage, leek, salad leaves/lettuce, potato, pumpkin, and spinach	Brussels sprouts, salad leaves/lettuce, and spinach

3.3.2 Uses of surplus

Farmers managed surplus in multiple ways, often depending on the type of crop, and access to a market for partial return on the cost of production. There were two main pathways for achieving a partial financial return on the cost of production: animal feed (61%) and food processing (35%). Prices received for surplus ranged from €5-200/tonne, with an average of €51/tonne. The higher price-point reflects use for processing, especially as food ingredients, with an average price received of €150/tonne. Processor uses included pre-sliced vegetables, juice, jam, frozen fruit, and vinegar, or industrial processing, e.g. starch. The lower price-point in the range reflects the price for animal feed, with an average price received of €29/tonne. In addition to selling edible surplus as animal feed, others gave it away (6%) or exchanged it for farmyard manure to use as fertilizer (16%).

Pathways without a direct financial return included leaving food unharvested (52% of farmers), use as compost or spread directly on fields (39% of farmers), donation of food (6% of farmers), or paying to have it removed for anaerobic digestion (3% of farmers). Surplus was generally left unharvested if it was not harvestable, or would not be profitable to harvest. Surplus was used as compost or spread on the fields to add nutrition back to the soil, although where this was not beneficial on the source farm, due to land being rented, it was given away to others for that purpose. For those that donated surplus, they did so through “gleaning” of unharvested food by volunteers (50%) or donation of food that has passed through the packhouse but cannot be sold (100%).

3.4 Experience of donating food

Almost two thirds of farmers (62%) have donated food previously to charities, e.g. St. Vincent de Paul and Penny Dinners, food redistribution organisations, e.g. FoodCloud, community groups, sports clubs, and employees. A number of farmers (32%) were still donating at the time of the survey. Farmers donating produce were mostly field crop growers, e.g. potato, root vegetables, and brassicas. Six farmers indicated the reasons why harvested food became surplus for donation, with four donating surplus produce (two at present and two in the past), one donating cancelled orders of packaged produce, and one donating produce that was outside of retailer size specifications.

Half of the farmers currently donating food were farming on very large farms (≥ 100 ha), and most were farming potatoes (60%), root vegetables (70%), and brassicas (50%). Of the 10 farmers who had donated food in the past, farmers were evenly distributed across farm size categories, while most were farming potatoes (50%), root vegetables (40%), brassicas (30%), and other field vegetables.

Almost a third (32%) of farmers had never donated food in the past. Half of these were farming very small farms (< 2 ha), while most were farming root vegetables (30%), brassicas (40%), and salad vegetables (30%). The farmers who did not respond to this question (6%) were fruit growers who reported having no food surplus or waste.

3.4.1 Interest in donating food

Farmers who were interested in donating food surplus, or were currently donating food, typically experienced at least 5% crop losses, and up to 50%. However, this was not always the case, with some farmers having an interest in donating food, despite indicating that they do not have surplus. Most (82%) of the 11 farmers who had never donated food surplus said that they were interested in doing so. These farmers produced brassicas (45%), salad vegetables (45%) and root vegetables (excluding potato) (36%). They were mostly farmers with very small farms of less than 2ha (55%), although some had farms greater than 20ha (27%). In particular small-scale growers and salad vegetable growers are farmer groups with potential to benefit from surplus food redistribution due to the relatively high volumes of crop losses. Those who were not interested in donating produce were fruit and mushroom growers with medium and small-scale farms (less than 20ha), who were also the farmers least likely to have surplus.

3.4.2 Challenges related to food donation

The main challenges for food donations included: logistics, e.g. transport (48%), time required (39%), process adjustment (29%), storage (10%), and packaging (10%). A number of farmers (32%) did not face or anticipate facing any challenges. Logistics challenges include transporting produce and arranging collection. Time challenges included staff shortages (29%), with farmers indicating a limited capacity to offer more competitive salaries. Other time challenges included the time required for all the harvest and post-harvest steps to “produce” the food, i.e., harvesting, packing, packaging, and transporting surplus, which reduces availability of existing staff for other tasks that have a greater economic return. Process adjustment challenges mostly concerned separation of surplus, for example packhouse re-organisation.

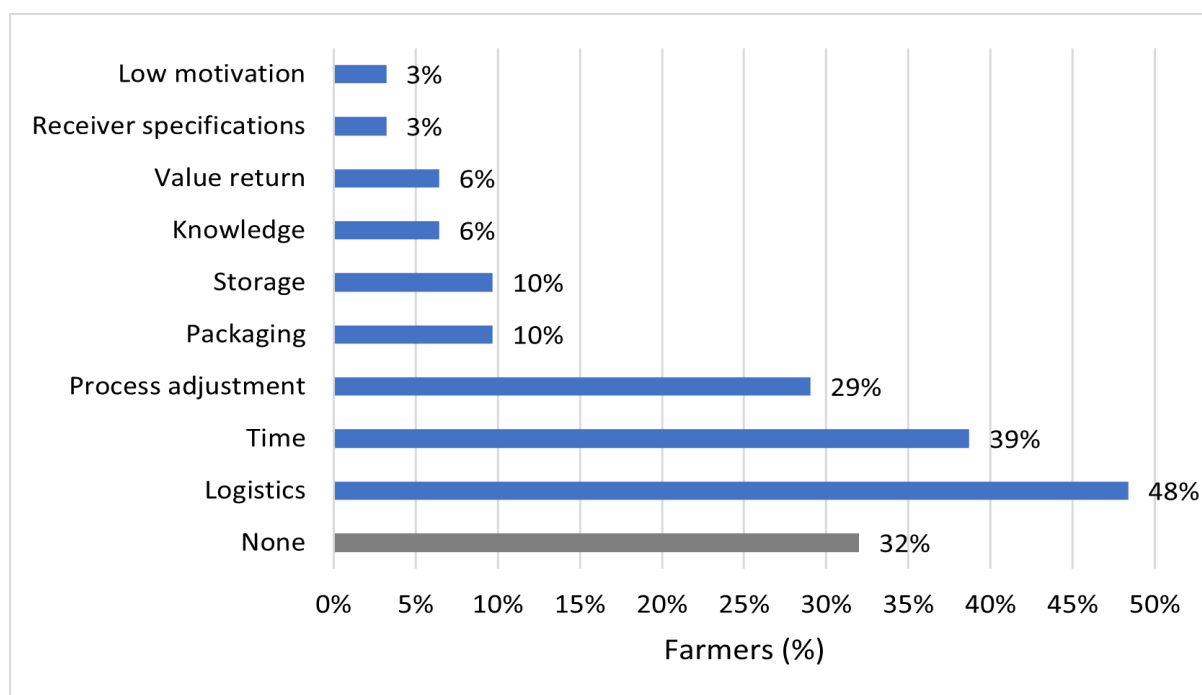


Fig. 5 Challenges experienced by farmers related to donating farm surplus (n = 31).

3.4.3 Collection window

Most farmers (71%) indicated the likely notice periods within which they would be able to inform food redistribution organisations of available surplus for donation, before that surplus spoils and becomes inedible. Notice periods depended on the crop type, season, and the maturity and extent of spoilage in the crop prior to the donation decision, e.g. if donation is chosen because a sale agreement fell through at short notice. For most crops (58%), a notice period of 12 to 48 hours was realistic, due to the tendency of the crop to spoil quickly, especially in warm conditions, e.g. broccoli and brussels sprouts, or farms trying to find a buyer before the end of the viable product storage period. For the remainder (52%), between two and six days notice was possible, giving time for food redistribution organisations to coordinate collection or delivery of produce and timely payment. For some crops longer periods of a week and even a few months' notice are possible (35%), for example crops that store well such as potatoes, apples, and swedes, and farms that can predict consistent volumes of surplus in season due to relatively high levels of expected post-harvest losses, e.g. due to stringent retailer specifications.

3.4.4 Resources and initiatives to support food donation

In terms of supports for donating food, most farmers wanted more knowledge about how to donate produce (42%) and sought adequate compensation (39%), while 29% felt they did not need any further supports to donate produce, including farmers with losses upwards of 10% of potential harvest. Almost a fifth of farmers (19%) wanted support with meeting labour requirements for food donation, including packhouse/gleaning volunteers. Figure 6 describes the main areas where farmers wanted support.

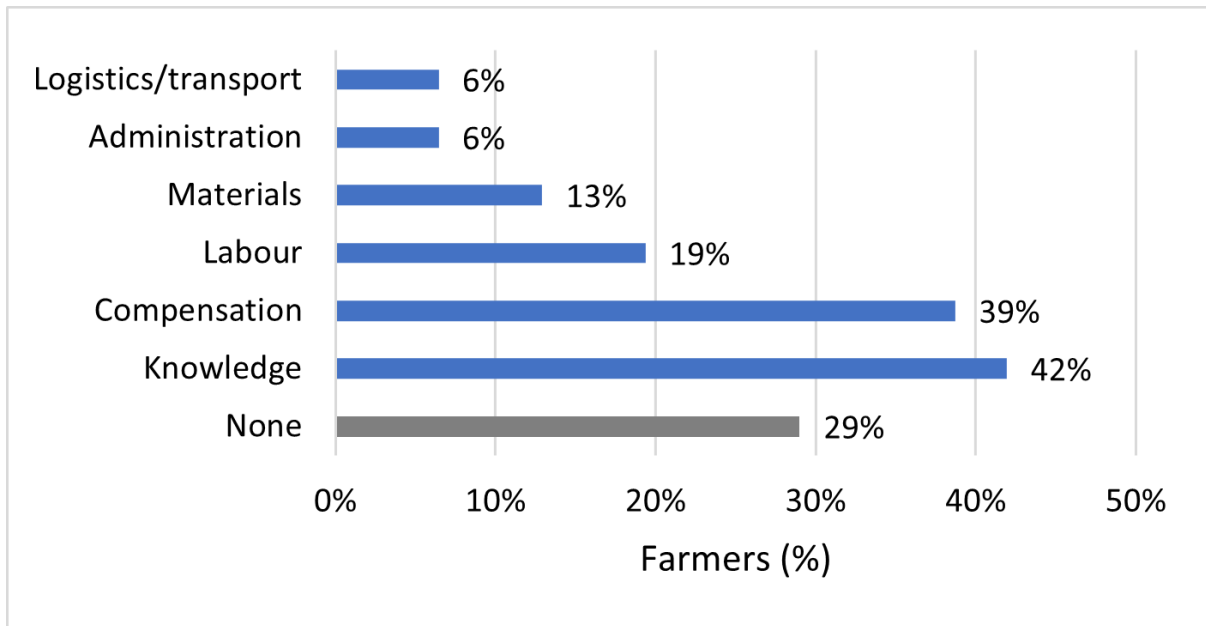


Fig. 6 Summary of supports needed by farmers to facilitate farm surplus donation (n = 31).

In addition to the supports farmers identified, a number of farmers also proposed other interventions for redistributing surplus food. These included establishing a food donation area at rural open food hubs, a dedicated phone line to contact FoodCloud about surplus, and a farmer-facing platform to communicate about what the demand for specific produce is, where it can be picked up from/dropped off to, etc. Farmers' needs differed within the categories of supports. Specific needs within each category are described in Table 3.

Table 3. Detailed description of supports needed by farmers to facilitate farm surplus donation (n = 31).

Knowledge about:	Compensation	Labour	Materials	Administration	Logistics
Logistics (26%)	All costs (13%)	Recruitment, e.g. gleaning/ packhouse volunteers (19%)	Clear food packaging specifications, e.g. bulk deliveries, return of crates (10%)	Minimal administration requirements (6%)	Coordination of food donations through wholesalers, e.g. “drop-off” pallet for small amounts of surplus (6%)
Guidelines (16%)	Packaging costs (13%)	Outsourcing of surplus grading and packing, e.g. by food redistribution organisations (3%)	Clearly labelled containers for sorting food surplus at packhouse (3%)		
Donation requirements (10%)	Labour costs (10%)				
Own capacity for donation (3%)	Transport costs (10%)				
Charity demand (3%)	Packhouse renovation/ reorganisation costs (6%)				
Charity use of food (3%)	Non-monetary compensation by regulatory bodies, e.g. Origin Green recognition of donations (3%)				

4. Pilot

4.1 Introduction

The pilot study part of this project was inspired by the Surplus with Purpose Fund developed by UK Food Redistribution NGO, FareShare. The pilot involved the provision of funding to farm organisations to cover costs associated with recovering surplus produce, that might otherwise not be harvested or sent for animal feed, for onward distribution to charities via FoodCloud. The objectives were to assess if the provision of funding supported more growers to participate in food redistribution as a way to reduce farm level food waste and increase food security in Ireland.

4.2 Recruitment and Engagement of Pilot Participants

Initially, it was a challenge to find growers that were willing to participate in the pilot. Reasons provided by the growers for not participating included;

- Severe resource constraints due to Covid-19,
- Adverse weather conditions during Autumn 2021 combined with increased retail sales during the Covid-19 pandemic meant that there was little to no edible surplus in certain crops (e.g. mushrooms),
- The timing of the pilot period did not suit some growers although they expressed an interest in taking part in the future.

In total 15 growers expressed an interest in getting involved in the pilot. Each grower who was interested in participating had a call / meeting with FoodCloud to discuss the following;

- Where and how the surplus was arising,
- What was the planned waste stream for the surplus,
- Was it possible to make the surplus available to FoodCloud,
- If so, what costs would need to be covered,
- What was the best operational approach to getting the surplus from the grower to FoodCloud

If FoodCloud and the grower were happy to proceed, FoodCloud developed a proposed approach briefing document and sent it to the grower for review and approval. This document included a proposed start date and a spreadsheet for the grower to provide details of the costs to be covered for completion once the pilot was initiated.

Ultimately five growers worked with FoodCloud to direct surplus edible food to redistribution to community groups rather than other waste streams. This involved FoodCloud covering the cost associated with making the surplus available. Eligible costs included labour, transport, packaging, and harvesting costs. Further details are provided below but in summary; Grower A started providing surplus in October 2021 for a 14 week period, Growers B & C started in December 2021 and provided surplus for 9 and 8 weeks respectively. Grower D started in December 2021 and provided surplus for 8 weeks. Finally, Grower E provided a once off delivery of surplus apples that had been harvested into juice in March 2022.

4.2 Pilot Impact Overview

The pilot resulted in the redistribution of 30,647kg of produce that would otherwise have remained unharvested or sent for animal feed. Produce was recovered from five different growers and included potatoes, cabbage, onions, leeks, beetroot, swede, red cabbage, carrots and apples which were converted to juice.

Table 4: Pilot Impact

Grower	Produce	KGS Provided	Alternative Destination
Grower A	Potatoes	8,200	Unharvested
Grower A	Cabbage	3,075	Unharvested
Grower A	Onions	3,650	Unharvested
Grower A	Leeks	700	Unharvested
Grower A	Beetroot	10	Animal Feed
Grower B	Swede	6,192	Animal Feed
Grower C	Red Cabbage	3,600	Animal Feed
Grower D	Carrots	4,500	Animal Feed
Grower E	Apples (converted to juice)	720	Unharvested
Totals		30,647	

4.2.1 Environmental Impact

The pilot project had a positive impact in terms of GHG emissions avoided by redistributing this food that would have otherwise gone to waste. The approximate emissions avoided total 98,070kgs of CO₂-eq, further details below.

Table 5: Environmental Impact

Grower	Produce	KGS Provided	Kgs of CO₂-eq Avoided*
Grower A	Potatoes	8,200	26,240
Grower A	Cabbage	3,075	9,840
Grower A	Onions	3,650	11,680
Grower A	Leeks	700	2,240
Grower A	Beetroot	10	32
Grower B	Swede	6,192	19,814
Grower C	Red Cabbage	3,600	11,520
Grower D	Carrots	4,500	14,400
Grower E	Apples (converted to juice)	720	2,304
Totals		30,647	98,070

* To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved. The calculation is based on the average CO₂-eq emissions of the different food categories that can

be redistributed by FoodCloud. This figure was verified by KPMG and indicates that it provides a conservative estimate of environmental impact.

4.2.2 Economic Impact

The pilot made a positive economic contribution in the following ways;

- 125 different community organisations were provided with fresh vegetables with an estimated retail value of €29,910 over the 5 month pilot period.
- Five new growers started working with FoodCloud as a result of this project and recovered €13,621 in costs by redistributing this produce rather than wasting it.

Table 6: Economic Impact

Grower	Produce	KGS Provided	Retail Value of the Produce*	Total Retail Value
Grower A	Potatoes	8,200	€0.80	€6,560.00
Grower A	Cabbage	3,075	€0.99	€3,044.25
Grower A	Onions	3,650	€1.57	€5,730.50
Grower A	Leeks	700	€2.58	€1,806.00
Grower A	Beetroot	10	€2.69	€26.85
Grower B	swede	6,192	€0.49	€3,034.08
Grower C	Red Cabbage	3,600	€0.99	€3,564.00
Grower D	Carrots	4,500	€0.99	€4,455.00
Grower E	Apples (Juice)	720	€3.50	€1,680.00
Totals		30,647		€29,900.68

*Prices taken from Tesco's online shopping site, February 2022.

Social Impact:

Through this project approximately 72,969 meals equivalent were provided via 125 community groups across the country as detailed in the table below, note some charities received produce from each of the participating growers. The total number of individual charities supported is 125. The importance of access to nutritious produce is highlighted in the below feedback from FoodCloud's charity partners;

"The variety made available to us through our FoodCloud collections has enabled us to offer a wider variety of nutritious meals to our elderly clients, while helping us to keep our centres running costs low." Killarney Community Services.

"Foodcloud has been brilliant to our organisation as we have access to a wide variety of veg and also lots of fruit which our elderly clients wouldn't have only for Foodcloud...There is significant saving working with Foodcloud so we are delighted with the surplus food we get" Bantry Cared for the Aged (Meals on Wheels service).

"We have 112 children attending the nursery each day. We are able to give them a balanced nutritional meal each day. We make up food hampers for parents and distribute food to other

community organisations for their clients. We have saved a lot of money.” Our Lady’s Nursery, Ballymun.

Table 7: Social Impact

Grower	Produce	KGS Provided	Meals equivalent Recovered*	No. of Charities Supported
Grower A	Potatoes	8,200	19,524	25
Grower A	Cabbage	3,075	7,321	31
Grower A	Onions	3,650	8,690	57
Grower A	Leeks	700	1,667	21
Grower A	Beetroot	10	24	1
Grower B	swede	6,192	14,743	75
Grower C	Red Cabbage	3,600	8,571	66
Grower D	Carrots	4,500	10,714	81
Grower E	Apples (juice)	720	1,714	20
Totals		30,647	72,969	125

* To calculate equivalent meals donated, FoodCloud applies a conversion factor of 1 meal = 420g (or 1kg = 2.381 meals). This aligns with international best practice used by food redistribution organisations globally. Furthermore, the standard was developed with Irish and UK retail partners and verified by Anthesis, an independent external consultancy, through testing in retail stores.

4.3 Pilot Operational and Financial Review

4.3.1 FoodCloud Operations

As FoodCloud has an existing infrastructure in place for food redistribution, the pilot was very easy to execute from an operational perspective. Once the proposed operational approach was agreed, the produce was simply received into our Hub in Dublin or Galway, logged and sorted for onward distribution to our existing network of charity partners. Of the five growers who participated, one needed a collection at the farm in Offaly which was facilitated by our Galway Hub, two provided the produce via an aggregator based in Dublin and FoodCloud collected from that site weekly, the remaining two growers delivered directly to FoodCloud’s Dublin Hub.

For this project to scale further a number of issues would need to be considered;

- At a small scale transport did not represent a problem for FoodCloud, however at a larger scale FoodCloud would need to either insist on the growers transporting the product to the Hubs or alternatively FoodCloud could provide transport through a third party logistics provider. FoodCloud would need to recoup transport costs for this activity.
- The funding available for the project was a limiting factor for the amount of produce that could be taken. Three of the five growers stated that they were only providing a small percentage of the surplus produce that was available and all noted that they had an abundance of grade II vegetables with very limited markets.

- The charity demand for certain produce is a limiting factor in scaling the project, more details on charity demand provided in the next section.
- If the project were to scale, FoodCloud would need to be more innovative in relation to how vegetables are redistributed to charities i.e. the creation of veg boxes with a variety of different vegetables every week.
- There were no growers directly providing surplus to the Cork Hub so surplus had to be transported internally from Dublin. A better regional spread of growers would be preferable.
- FoodCloud has an existing network of growers who donate surplus produce already, there were occasions where there was a large supply of produce from existing donors and new growers through this project. Whilst FoodCloud succeeded in redistributing all the surplus, at a larger scale this could present a problem.

4.3.2 Charity Demand

FoodCloud works with a network of over 600 community and voluntary organisations that are embedded in communities and are addressing the most pressing environmental, social, and economic issues we face at a grassroots level. This network includes some of Ireland's largest community organisations such as Youthwork Ireland, Crosscare, SVP and Simon Communities. It also includes very small grassroots organisations including Housing Associations, Community Childcares, Youth Services and Family Resource Centres. The diversity of this network can be understood both in the diversity of the services they deliver and the diversity of the people they work with. Their service users include older people, people experiencing homelessness, low income families, young people and people with addiction.

This project was limited to those charities who work with FoodCloud Hubs and directly supported 125 different community groups. FoodCloud have estimated that currently, there is a requirement for 5.5 tonnes of produce weekly or 286 tonnes annually and expect to grow that demand by 15% year on year through increased number of charity memberships and other FoodCloud projects.

Charity-related observations from the pilot include;

- Charities have a preference for produce to be packaged in 1-2kg bags (especially carrots, potatoes, onions) as a lot of charities, especially during Covid-19, are providing food directly to service users rather than in catering facilities. One grower, who provided surplus carrots in the pilot, was happy to facilitate this by packaging their product into 1kg bags, and the price of this was incorporated into the cost of providing the produce.
- Charities have a preference for certain types of fruit and vegetables. By way of example the red cabbage redistributed during the pilot did present some challenges.
- For longer life produce (e.g. swede) charities may not require it on a weekly basis.
- For the charities, consistency of the produce is key. Once they can rely on the produce being available week on week they will stop buying it from other sources and thus demand for surplus will increase.
- FoodCloud would need to grow their network of charity partners, particularly those charities that can use fresh produce.
- A lot of the larger charities use pre-prepared and chopped vegetables in their service due to their own resource constraints, which limits their ability to take fresh produce.

- FoodCloud would need to conduct more research with their charity network to understand their needs in terms of type, volume and frequency of produce required, as has already been done in relation to ambient food ([FEAD](#)).

4.3.3 Financial Sustainability

The total direct costs to FoodCloud to operationally deliver the pilot project amounted to €26,799. This includes the cost provided to the growers of €13,621 and the direct cost to FoodCloud of redistributing the products to charities, this is estimated at €0.43 per kg and totalled €13,178. The FoodCloud costs do not include the project management associated with establishing the pilot and other indirect costs to deliver FoodCloud's core services.

Table 8: Project Cost

Cost Category	Total Cost
Produce Total	€13,621
FoodCloud's cost per kg redistributed is €0.43	€13,178
Total Direct Project Cost	€26,799

Based on these figures, if the project were to scale in its current form to meet the total projected needs of our charity partners, which FoodCloud estimate to be 5.5 tonnes of produce per week and that demand would grow by 15% per year, a conservative estimate for the cost to deliver the project is as follows;

Table 9: Funding required for the project to scale

	Year 1	Year 2	Year 3
Tonnes of surplus required	286	329	378
Total Costs Required	€291,140	€330,579	€375,722

Financial observations from the pilot include;

- Growers were inclined to think and talk in terms of the "price" that they would be able to provide the produce for rather than the "cost" of making it available to FoodCloud.
- The "cost" provided depended on what stage the produce was at before it was made available to FoodCloud. For example, the product that was going to remain unharvested was a lot more costly to redistribute than produce that was in the pack house and destined for animal feed.
- Based on the limiting factors of FoodCloud's scale and the charity demand coupled with the apparent abundance of grade II produce (especially in root vegetables) it appears that FoodCloud could take a market-based approach for specific Grade II products and volumes at an agreed price based on the demand of the charity sector. This would allow FoodCloud control over product type, frequency and collection in a way that would better meet the needs of the charities and still support in the recovery of food waste.
- In the research part of this study, farmers identified logistics, time, process management, and storage as the main challenges to the provision of surplus. There is an opportunity to invest in FoodCloud's facilities to increase ability to take large

volumes of surplus, grade II vegetables i.e. washing, sorting and packing, storage (chilled and frozen) and processing capabilities (where produce could be processed into longer shelf life products, which may have higher value e.g. meal preparation, product development, preservation). This would reduce the cost, resources and time required by the farmers to make the surplus product available, e.g. FoodCloud could take large containers of product rather than dictating a pack size preference.

- FoodCloud has existing donors of surplus vegetables who provide produce at no cost. There is a tension between this project sitting alongside those existing relationships.
- Given the volume of grade II produce that is potentially available there is an opportunity to look at other innovations outside of distribution to charities in Ireland.
 - A social enterprise in Holland, [Instock](#) has created a marketplace for producers to connect directly with the hospitality sector to trade surplus food. The viability of this solution in Ireland would need to be investigated further.
 - Funding for farmers to invest in on-site processing technology, adding value to produce that might otherwise have low returns or become waste.

4.4 Pilot Case Studies

4.4.1 Case Study #1 - Grower A

Background:

Grower A, based in Co. Offaly, produce a range of vegetables, including potatoes, cabbage, onions, leeks, kale, garlic and beetroot. They harvest and sell at three local farmers markets and also supply to the wholesale market.

Why surplus arises & how they manage it:

Surplus can arise for the following reasons;

- Small amounts of surplus product arise weekly that don't sell at farmers markets.
- They need to produce a certain amount of surplus beetroot for a sister company that juices beetroot, to ensure security of supply and opportunity for growth for that company.
- Produce is grown for the wholesale market based on forecast sales. If demand is weaker than anticipated they will have surplus produce. By way of example, in Summer/Autumn 2021 yields were better than expected, while wholesale demand was lower than expected due to Covid-19 restrictions in the hospitality sector. As a result they knew they were likely to not sell all of that year's harvest and would have surplus.

Generally the surplus would either be used for animal feed within the farm or remain unharvested where the land was either grazed by livestock or the produce was ploughed back into soil.

Motivation for participation in the pilot:

They were equally motivated by getting some of their costs covered and to cut down on farm level food waste. The fact that this project was also contributing to the charity sector was a benefit on top of that.

Operational Approach:

The grower was in a position to provide the surplus produce if FoodCloud covered the costs associated with the additional tasks involved. In this case, it included labour, harvesting and packing. Operationally, the following was agreed for the pilot period:

- A standard weekly collection day was agreed.
- FoodCloud would collect the produce using their own transport from the Galway Hub.
- High level costs were agreed at the start of the pilot.
- Details of the produce, volumes and costs required were provided via email the day before the collection. An invoice was provided with each donation detailing what product, volumes and the costs associated with each. FoodCloud processed payment monthly.
- The produce was redistributed to charities via FoodCloud's Galway Hub and ran for 14 weeks from October 2021 to February 2022.

Overall Impact:

Table 10: Grower A impact

	KGS	GHG emissions avoided (kgs CO₂-eq)*	Meals equivalent provided**	No. of charities supported
Potatoes	8,200	26,240	19,524	
Cabbage	3,075	9,840	7,321	
Onions	3,650	11,680	8,690	
Leeks	700	2,240	1,667	
Beetroot	10	32	24	
Totals	15,635	50,032	37,226	64

* To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved.

** To calculate equivalent meals donated, FoodCloud applies a conversion factor of 1 meal = 420g (or 1kg = 2.381 meals).

Feedback from the grower regarding the pilot:

- Operationally very efficient to make the product available to FoodCloud
- The fact that FoodCloud could collect was beneficial but the farm could accommodate delivery if required in the future
- There was a good contribution to cost which supported overall financial sustainability of the farm
- As a result of the pilot they had very little farm level surplus this season
- They could have donated more (e.g. carrots, beetroot) but wanted to make sure that others could also participate in the pilot and did not think there would be a demand for beetroot from charities.
- Would be interested in participating in the longer term and would be able to provide some level of surplus for 9/10 months of the year (May/June there would be limited surplus)
- It is likely that in future the surplus available wouldn't be as consistent as it was in this pilot period, this may mean that more flexibility in relation to variety in the volume and the product available would be required.

4.4.2 Case Study #2 - Grower D

Background:

Grower D is a mixed farming operation based in Kilkenny. The farm consists of 280 hectares of crops, including carrots, parsnips, pumpkins, cereals, flower bulbs, onions and grassland. Crops and cereals are produced for domestic and export supply with the majority of the produce processed and packed on site before distribution to the major retailers. For this project, the focus was on carrots only.

Why surplus arises & how they manage it:

Most of the surplus in carrot production arises in the pack house during the grading process. Carrots that do not reach retail specifications e.g. misshapen, broken, or over and under-sized carrots, would be classed as Grade II, graded out and generally sent for animal feed.

Motivation for participation in the pilot:

The primary motivation of the grower was to reduce waste of perfectly edible surplus and increase the amount of produce that was generating some revenue to support the financial sustainability of the business. The fact that there was a social benefit to the pilot project was an additional motivating factor.

It was noted that currently only about 70% of what comes into the pack house was making it to the retail market, the grower is continuously looking at ways to increase that. If all of the produce could be utilised it would mean that 30% less resources, including land, would be needed to grow the same amount of produce. This would be much more environmentally and financially sustainable.

Operational Approach:

Grower D was in a position to provide the surplus Grade II produce if FoodCloud covered the costs associated with the additional tasks involved, in this case it included labour, packing and delivery costs. Operationally, the following was agreed for the pilot period:

- A standard weekly delivery day was agreed.
- Based on the limitations of the funding available in the pilot and the charity demand it was agreed that FoodCloud would cover the cost of 500kg of carrots, packed in 1kg bags for the pilot period.
- The Grower delivered the product to FoodCloud Hubs in Dublin weekly on an existing delivery route.
- The produce was redistributed to charities via FoodCloud's Dublin Hub to 81 different community organisations.
- The pilot ran for 9 weeks from December 2021.

Overall Impact:

Table 11: Grower A pilot impact

	KGS	GHG emissions avoided (kgs CO₂-eq)*	Meals equivalent provided**	No. of charities supported
Carrots	4,500	14,400	10,714	81
Totals	4,500	14,400	10,714	81

* To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved.

** To calculate equivalent meals donated, FoodCloud applies a conversion factor of 1 meal = 420g (or 1kg = 2.381 meals).

Feedback from the grower regarding the pilot:

- The grower could have provided 5 times the amount of produce available and could also have provided grade II parsnips but we were limited by the funding available through the pilot and the demand of the charity sector.
- Operationally very efficient to make the product available to FoodCloud and no operational improvements were recommended.
- While the cost recovered does not generate a margin it does help to cover business overheads.
- There is an opportunity for a lot more innovation in creating markets for Grade II produce in Ireland. In a retail setting the key is the marketing of the product, in the UK there is a lot more variety of produce on retail shelves, for example, baby carrots, baby turnips, Asda's grower's selection produce. Developing different product offerings would support growers in selling more of their produce.
- Given the abundance of Grade II produce within the horticulture sector in Ireland, there is an opportunity for FoodCloud to dictate product required, volume required, frequency required and price FoodCloud are willing to pay. This would allow FoodCloud to meet the charity demand better and control the supply better. They would still be supporting the reduction of food waste by providing a market for Grade II produce.
- For growers to innovate in this area including investment in machinery, market research etc, more favourable pricing and longer terms contracts with retailers would be required.

4.4.3 Case Study #3 - Total Produce

Background:

Growers B & C participated in the pilot project via Total Produce who grow, source, import, package, distribute and market over 200 lines of fresh fruits, vegetables and flowers. Total Produce introduced the pilot concept to two of the growers who supply Total Produce, and they agreed to participate in the pilot. Grower B produces red cabbage and Grower C produces swede. Both growers are based in North County Dublin.

Why surplus arises & how they manage it:

The two growers outlined that the surplus arose where the produce did not reach retailer specifications e.g. misshapen, broken, or over and under-sized. In the case of the red

cabbage they were generally under-sized, while the swedes were generally over-sized. The two growers reported that this produce is either sent for processing, at a low price, or used as animal feed.

Motivation for participation in the pilot:

For Total Produce the primary motivation was to reduce waste, and support growers to get a financial contribution for surplus as the margins in the sector are so tight. Grower B noted that reducing waste and getting some financial compensation was the primary driver, Grower C was motivated to participate in the pilot to support local communities.

Operational Approach:

Operationally, the following was agreed for the pilot period:

- Based on the limitations of the funding available in the pilot and the charity demand it was agreed that FoodCloud would cover the cost of 450kg of red cabbage and 774kg of swede weekly for 8 weeks.
- Total Produce placed the order for the grade II with the growers weekly to coincide with their existing deliveries to the site.
- The growers delivered the product to Total Produce in Swords and FoodCloud collected from there.
- The produce was redistributed to charities via FoodCloud's Dublin Hub to 75 and 66 different community organisations respectively.
- The pilot ran for 8 weeks from December 2021.

Overall Impact:

Table 12: Grower B&C pilot impact

	KGS	GHG emissions avoided (kgs CO ₂ -eq)*	Meals equivalent provided**	No. of charities supported
Swede	6,192	19,814	14,743	75
Red Cabbage	3,600	11,520	8,571	66
Totals	9,792	31,334	23,314	

* To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved.

** To calculate equivalent meals donated, FoodCloud applies a conversion factor of 1 meal = 420g (or 1kg = 2.381 meals).

Feedback from the grower regarding the pilot:

- Both growers had more produce potentially available but were limited by the funding available through the pilot and the demand of the charity sector.
- Total Produce also have a wider network of growers that they could engage with on this project in the future.
- Both growers noted that it was operationally very efficient to make the product available to FoodCloud via Total Produce.
- Total Produce noted the weekly drop off and collection was efficient from their perspective.
- One grower noted that he thought the project was a good way to introduce new growers to FoodCloud and both would be keen to continue with the project.
- Total Produce noted that this project adds value for growers and adds value to communities. There is currently no financially sustainable way to sell Grade II product, this project does meet the objectives of reducing farm level food waste, supporting growers with a financial contribution and providing access to nutritious food to communities.

4.4.4 Case Study #4 - Grower E

Background:

Grower E is a third generation fruit grower with facilities in Armagh and Dublin. The business provides to the fresh produce, fresh fruit juice and cider markets; growing, storing, packing, pressing and producing apples, pears, organic apples/pears along with processed diced/sliced apple and rhubarb as well the company's own branded Apple Juice and Cider range.

Why surplus arises & how they manage it:

The business has limited surplus due to the fact that they also engage in on-site processing into a number of products at their state of the art facility in Armagh. Some surplus arises in relation to Irish heritage apples, which are grown in a small number of orchards. These apples are good for biodiversity but have limited demand in the retail market and also have a shorter shelf life than the apples that consumers are accustomed to buying. The surplus would have remained unharvested.

Motivation for participation in the pilot:

Primarily to support the social impact of getting the product out to community organisations around the country.

Operational Approach:

The grower agreed to harvest the heritage apples and juice them so as to make it easier for FoodCloud to facilitate onward distribution to charities. The costs covered included harvesting, juicing and bottling. The grower facilitated transport to FoodCloud's Dublin hub on an existing route. It was agreed that one batch of juice would be provided, using 720kgs of surplus apples to produce 480 bottles of 75ml juice. The bottles were delivered to FoodCloud in March 2022.

Overall Impact:

Table 13: Grower E pilot impact

	KGS	GHG emissions avoided (kgs CO₂-eq)*	Meals equivalent provided**	No. of charities supported
Apples (Juiced)	720	2,304	1,728	20

* To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved.

** To calculate equivalent meals donated, FoodCloud applies a conversion factor of 1 meal = 420g (or 1kg = 2.381 meals).

5. Conclusions**5.1 Surplus in Irish agriculture**

Almost four out of every five farms surveyed (77%) experience edible losses (surplus). Those most likely to experience losses were large-scale specialist growers of broccoli, field vegetables (potato, root vegetables) and salad vegetables, and small-scale growers of mixed vegetables. Crops with surplus all year round include beetroot, broccoli, cabbage, carrot, cucumber, kale, salad leaves/lettuces, leeks, onion, parsnip, potato, pumpkin, and swede/turnip. These crops present a great opportunity for food redistribution, due to their year-round availability. In addition, some store well, e.g. potato, pumpkin, swede/turnip, while others present an opportunity for on-site processing by charities or collaborations between food processors and charities, to enhance the crop shelf-life and diversity of uses e.g. beetroot, carrot, and cabbage. Those least likely to experience surplus include mushroom growers and fruit growers, and consequently these farms are least likely to be in a position to donate surplus food.

Almost two in three farmers (62%) have donated food in the past, predominantly growers of field crops, e.g. potato, root vegetables, and brassicas. Small-scale growers and salad vegetable growers were among those who had never donated. These farmers have surplus and are interested in donating it, so there is a clear opportunity to engage these farmers in food donation. Farmers identified logistics, time, and process management as the main

challenges to surplus donation. Of the farmers who participated in the pilot study, all but one reported that they could have increased the amount of grade II produce they provided by at least double.

5.2 Surplus pathways

Farmers used multiple pathways to manage surplus, depending on the crop, and on non-retail market conditions. Financial returns were possible for surplus that was sold as animal feed or for food processing. These surplus pathways were used by 61% and 35% of farms respectively, while most farms also used uncompensated surplus management pathways, e.g. leaving produce unharvested (52%) and spreading it on fields/as compost (39%). The average price received for animal feed was €29/tonne, with animal feed also being given away or exchanged for farmyard manure to use as fertiliser. The average price received for processing was €150/tonne, for use as pre-sliced vegetables, juice, jam, frozen fruit, and vinegar, and industrial processing, e.g. starch. Only a few farms have invested in on-site processing technology, adding value to produce that might otherwise have low returns or become waste, e.g. due to being outside supermarket specifications. The initial investment and staffing costs of on-site processing technology, especially for small and medium-size farms, would require financial support, similar to that which has been provided by the Targeted Agricultural Modernisation Scheme (TAMS).

The pilot study indicated that there is an opportunity for more coordination among farmers to develop and effectively promote innovation regarding grade II product, e.g. “mini” vegetables that are outside retailer specifications. Greater support from public bodies such as Teagasc and the Department of Agriculture, Food and the Marine, and from retailers, for farmer collaboration and innovation concerning produce that might otherwise be wasted, could greatly contribute to reducing waste within the sector and maximising use of edible produce. Producer organisations, e.g. farmer co-operatives, also provide an organisational structure that can support farmers in reaching these objectives and strengthening farm financial viability. This approach already has had substantial success in other areas of Irish agriculture, e.g. the dairy sector, and could unlock new opportunities for innovation and development in the horticulture sector.

5.3 Impact and future viability of the pilot project

The pilot resulted in the redistribution of 30,647kg of produce that would otherwise have remained unharvested or sent for animal feed. Produce was recovered from five different growers and included potatoes, cabbage, onions, leeks, beetroot, swede, red cabbage, and carrots and apples in the form of juice. The pilot had the following impacts;

- **Environmentally;** approximately 98,070kgs of CO₂eq were avoided by redistributing this food that would have otherwise gone to waste.
- **Economic;** 125 different community organisations across the country were provided fresh vegetables, with an estimated retail value of €29,900, over the 5 month pilot period. Five new growers started working with FoodCloud as a result of this project and recovered €13,621 in costs by redistributing this produce rather than wasting it.
- **Social;** Through this project, 721,969 meals equivalent were provided via 125 community groups across the country.

The funding available for the project was a limiting factor for the amount of produce that could be distributed. Three of the five growers stated that they were only providing a small percentage of the surplus produce that was available and all noted that they had an abundance of Grade II vegetables, with limited markets for them.

If the project were to scale in its current form to meet the needs of FoodCloud's existing charity partners nationwide, which we estimate to be 5.5 tonnes of produce per week (growing by 15% per year), a conservative estimate for the cost to deliver would be €291,000 in year one, rising to €375,000 in year three. This would result in €126-166,000 going back to growers and €165-208,000 towards FoodCloud to cover the cost of distribution to charities.

The following areas would need to be considered further if the project were to scale;

- Based on the limiting factors of FoodCloud's scale and the charity demand coupled with the apparent abundance of grade II produce (especially in root vegetables). FoodCloud could review demand with the charity sector in more detail and take a market based approach for specific Grade II products and volumes at an agreed price. This would allow FoodCloud control over product type, frequency and collection in a way that would better meet the needs of the charities and still support the recovery of food waste.
- There was a significant difference between the average price that growers received for processing (€150 per tonne) and the average cost the growers provided for provision of surplus to FoodCloud as part of the pilot. This indicates that there is such a low floor price for processing/animal feed that any scheme that would fund the growers cost to redistribute to community groups would disrupt the processor and animal feed markets and out-compete those existing buyers.
- FoodCloud would need to conduct research with our charity network to understand in more detail their needs in terms of type, volume, frequency and consistency of produce required, and it is likely that FoodCloud would need to grow our network of charity partners that can use fresh vegetables to adequately redistribute the amount of surplus available.
- In the research part of this study, farmers identified logistics, time, process management and storage as the main challenges to surplus donation. There is an opportunity to invest in FoodCloud's facilities to increase our ability to take large volumes of surplus Grade II vegetables. This would include washing, sorting and packing, storage and processing capabilities. This would reduce the cost, resources and time required by the farmers to make the surplus product available. For example, if capacity allowed, FoodCloud could take large containers of produce and sort them at their facilities rather than dictating to growers a preference for retail-sized packs.

6. Recommendations

It is recommended that this pilot project be scaled up. It is estimated that over a three year period this project could rescue 993 tonnes of surplus food that arises within the horticulture sector. This would require funding of up to €375,000 per annum, of which €166,000 per annum would be provided back to participating growers. It is further recommended that rather than scaling the pilot based on covering the costs associated with making the

donation, FoodCloud would review demand with the charity sector in more detail and take a market based approach for specific Grade II products and volumes at an agreed price. This would allow FoodCloud control over product type, frequency, and consistency in a way that would better meet the needs of the charities and still support the recovery of farm level food surplus at a fair price. A sustainable source of funding would need to be identified to support the project. This could be a government or private sector fund, or there is an opportunity to explore a tax deduction or tax credit system. This could involve the extension of the “Charity Donation Scheme” beyond donations of a monetary nature to material goods, such as agricultural products.

It is obvious that, even at scale, this project on its own will not address the overall problem of reducing edible farm level surplus. Therefore a number of further areas need to be explored;

- More **collaboration between farmers and retail actors** to develop better systems to manage retail specifications and innovate in this space, e.g. broadening retail specifications, marketing under-size vegetables as “minis” such as “tiny turnips”, and more communication with consumers about their influence, e.g. buying seasonal produce, and trying produce that is outside specifications, where available (e.g. misshapen vegetables).
- Creation of a financially sustainable **marketplace for grade II produce**, by way of example, a social enterprise in Holland, [Instock](#) has created a marketplace for producers to connect directly with the hospitality sector to trade surplus food. The viability of this solution in Ireland would need to be investigated further.
- **Investment in circular economy organisations** working in the area of food redistribution (FoodCloud) or valorisation (e.g. Cream of the Crop) to promote innovation and create new markets that can take large volumes of farm level edible surplus. This would include facilities to wash, sort, pack and store produce and also processing capabilities that could extend the life of the produce (e.g. juicing, meal preparation, product development). This would reduce the cost, resources and time required by the farmers to make the surplus product available.
- Investment in the horticulture sector to enable growers to **develop on-site processing technologies** to add value to produce that might otherwise have low returns or become waste. The initial investment, especially for small and medium-size farms, would require financial support, similar to that which has been provided by the Targeted Agricultural Modernisation Scheme (TAMS). Investment required to support innovation in horticulture also includes **advisory and business development supports**, similar to those provided to other primary producers by public bodies, e.g. Department of Agriculture, Food and the Marine, Teagasc and Bord Bia.
- **Stronger coordination between fruit and vegetable farmers** on this topic, including through farmer co-operatives and farmer representation organisations, e.g. the Irish Farmers Association, could strengthen farmer self-advocacy capacity, ensuring a better chance of success with engaging other food network actors, e.g. processors, retail, and consumers. Support from **rural development organisations**, e.g. Irish Rural Link, can also help to facilitate greater coordination between growers, and enhance self-advocacy within the sector.

References

- ABACO. 2020. "Reagro." 2020. <https://abaco.org.co/reagro/>.
- Albert Heijn. 2021. "Minder Verspillen." 2021. <https://www.ah.nl/over-ah/duurzaamheid/minder-verspillen>.
- Beausang, Ciara, Clare Hall, and Luiza Toma. 2017. "Food Waste and Losses in Primary Production: Qualitative Insights from Horticulture." *Resources, Conservation and Recycling* 126 (July): 177–85. <https://doi.org/10.1016/j.resconrec.2017.07.042>.
- Bord Bia. 2021. "Horticulture Member List." Certified Quality Assurance Members List . 2021. <https://www.bordbia.ie/farmers-growers/member-status/scheme-members/horticulture-member-list/>.
- City Harvest. 2022. "City Harvest." 2022. <https://www.cityharvest.org/>.
- Cork Penny Dinners. 2021. "Cork Penny Dinners." 2021. <http://corkpennydinners.ie/>.
- Cream Of The Crop Gelato. 2022. "Cream Of The Crop Gelato." 2022. <https://creamofthecropgelato.com/>.
- CSO. 2021a. "Census of Agriculture 2020 - Preliminary Results." Cork. <https://www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020-preliminaryresults/>.
- . 2021b. "Dataset AEA02 - Quantity of Agricultural Output ." Cork. https://data.gov.ie/dataset/aea02-quantity-of-agricultural-output?package_type=dataset.
- . 2019. "Ireland's UN SDGs 2019 - Report on Indicators for Goal 2 Zero Hunger." Cork. <https://www.cso.ie/en/releasesandpublications/ep/p-sdg2/irelandsunsdgs2019-report-on-indicators-for-goal2-zero-hunger/hunger/>
- Department of Agriculture Food and the Marine. 2020. "Ag Climatise - A Roadmap towards Climate Neutrality." Dublin. <https://www.gov.ie/en/publication/07f8e-ag-climatise-a-roadmap-towards-climate-neutrality/>.
- . 2021. "Food Vision 2030." Dublin. <https://www.gov.ie/en/publication/c73a3-food-vision-2030-a-world-leader-in-sustainable-food-systems/#food-vision-2030>.
- Department of the Environment, Climate and Communications. 2021. "Waste Action Plan for a Circular Economy." Dublin. <https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>.

- Environmental Protection Agency. 2021. "How Much Food Do We Waste in Ireland?" Wexford.
- European Commission. 2011. Commission Implementing Regulation (EU) No. 543/2011. Brussels: European Commission.
[https://www.fsai.ie/uploadedFiles/Consol_Reg_543_2011\(1\).pdf](https://www.fsai.ie/uploadedFiles/Consol_Reg_543_2011(1).pdf).
- . 2020. "Guidance on Reporting of Data on Food Waste and Food Waste Prevention."
<https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+food+waste+reporting/5581b0a2-b09e-adc0-4e0a-b20062dfe564>.
- European Commission Joint Research Centre, 2020. Brief on food waste in the European Union. Italy.
- Eurostat. 2022a. "Farm Indicators by Agricultural Area, Type of Farm, Standard Output, Legal Form and NUTS 2 Regions." Luxembourg: European Commission.
https://ec.europa.eu/eurostat/databrowser/view/EF_M_FARMLEG__custom_2109912/default/table?lang=en.
- . 2022b. "Vegetables by NUTS 2 Regions." *Statistics: Eurostat*. Luxembourg: European Commission.
https://ec.europa.eu/eurostat/databrowser/view/EF_LAC_VEGE__custom_2085565/default/table?lang=en.
- Facchini, Elisa, Eleni Iacovidou, Jan Gronow, and Nikolaos Voulvoulis. 2018. "Food Flows in the United Kingdom: The Potential of Surplus Food Redistribution to Reduce Waste." *Journal of the Air and Waste Management Association* 68 (9): 887–99.
https://doi.org/10.1080/10962247.2017.1405854/SUPPL_FILE/UAWM_A_1405854_SM6535.DOCX.
- Falling Fruit Ireland. 2020. "Falling Fruit Ireland - Urban Harvesting Project Helping Charities." 2020. <https://www.fallingfruit.ie/>.
- FAO. 2019. "The State of Food and Agriculture 2019. Moving Forward on Food Loss and Waste Reduction." Rome: FAO. <https://doi.org/10.4324/9781315764788>.
- FAO, IFAD, UNICEF, WFP, and WHO. 2021. "The State of Food Security and Nutrition in the World 2021." *The State of Food Security and Nutrition in the World 2021*. Rome: FAO, IFAD, UNICEF, WFP and WHO. <https://doi.org/10.4060/CB4474EN>.
- FareShare. 2022. "About the FareShare Surplus With Purpose Fund." 2022.
<https://fareshare.org.uk/giving-food/about-the-fareshare-surplus-with-purpose-fund/>.
- Feeding America. 2017. "Six Regional Produce Cooperatives Established." 2017.
<https://www.feedingamerica.org/about-us/press-room/produce-cooperatives>.

- FoodBank Australia. 2020. "250,000 Community Kitchen Meals in Western Australia." 2020. <https://www.foodbank.org.au/250000-community-kitchen-meals/?state=au>.
- FoodCloud. 2022. "FoodCloud: Food Waste Hurts Our Planet." 2022. <https://food.cloud/>.
- Giesen, Roxanne I. van, and Ilona E. de Hooze. 2019. "Too Ugly, but I Love Its Shape: Reducing Food Waste of Suboptimal Products with Authenticity (and Sustainability) Positioning." *Food Quality and Preference* 75 (February): 249–59. <https://doi.org/10.1016/j.foodqual.2019.02.020>.
- Global FoodBanking Network. 2022. "Home - The Global FoodBanking Network." 2022. <https://www.foodbanking.org/>.
- Government of Ireland. 2019. *Climate Action Plan 2019*. Dublin. <https://www.gov.ie/pdf/?file=https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf#page=null>.
- HLPE. 2014. "Food Losses and Waste in the Context of Sustainable Food Systems." Rome. <http://www.fao.org/3/a-i3901e.pdf>.
- IFA. 2022. "Retail Price Compression Threatens the Viability of Irish Horticulture." Dublin. <https://www.ifa.ie/wp-content/uploads/2022/03/IFA-Horticulture-Report-A4-Feb22-v8WEB.pdf>
- Instock. 2022. "Restaurant Instock Zet Voedselverspilling Op de Kaart." 2022. <https://www.instock.nl/>.
- Kinach, Lesia, Kate Parizeau, and Evan D.G. Fraser. 2020. "Do Food Donation Tax Credits for Farmers Address Food Loss/Waste and Food Insecurity? A Case Study from Ontario." *Agriculture and Human Values* 37: 383–96. <https://doi.org/10.1007/s10460-019-09995-2>.
- Northern Soul Kitchen. 2022. "Northern Soul Kitchen." 2022. <https://www.northernsoulkitchen.co.uk/about.html>.
- O'Connor, Tracey, Rosanna Kleemann, and Jennifer Attard. 2022. "Vulnerable Vegetables and Efficient Fishers: A Study of Primary Production Food Losses and Waste in Ireland." *Journal of Environmental Management* 307 (April): 114498. <https://doi.org/10.1016/J.JENVMAN.2022.114498>.
- OzHarvest. 2022. "OzHarvest Market Waterloo." 2022. <https://www.ozharvest.org/ozharvest-market-waterloo/>.
- Papargyropoulou, Effie, Rodrigo Lozano, Julia K. Steinberger, Nigel Wright, and Zaini Bin Ujang. 2014. "The Food Waste Hierarchy as a Framework for the Management of Food Surplus and Food Waste." *Journal of Cleaner Production* 76 (August): 106–15. <https://doi.org/10.1016/J.JCLEPRO.2014.04.020>.

- Revenue. 2021. "Charitable Donation Scheme." August 12, 2021.
<https://www.revenue.ie/en/companies-and-charities/charities-and-sports-bodies/charitable-donation-scheme/index.aspx>.
- Rubies in the Rubble. 2021. "Condiments. But Gooder." 2021.
<https://rubiesintherubble.com/>.
- Second Harvest. 2022. "Second Harvest - Food Rescue Charity In Canada." 2022.
<https://www.secondharvest.ca/>.
- SUNT. 2022. "About SUNT." 2022. <https://www.suntfood.com/en/about-us>.
- The Company Shop Group. 2022. "Community Shop." 2022.
<https://www.companyshopgroup.co.uk/apply-for-membership/community-shop>.
- Too Good To Go. 2022. "Join Our Food Waste Movement ." 2022.
<https://toogoodtogo.co.uk/en-gb>.
- United Nations. 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. Vol. A/RES/70/1.
- USDA. 2021. "USDA Farmers to Families Food Box." 2021.
<https://www.ams.usda.gov/selling-food-to-usda/farmers-to-families-food-box>.
- Vittuari, Matteo, Paolo Azzurro, Silvia Gaiani, Manuela Gheoldus, Stephanie Burgos, Lusine Aramyan, Natalia Valeeva, et al. 2016. "Recommendations and Guidelines for a Common European Food Waste Policy Framework." Bologna: FUSIONS EU.

Report 5 - Farm-Level Food Loss

Appendix 3 - WWF Global Farm Loss Tool in Ireland

In the 2025 harvest season, FoodCloud used the WWF Tool to obtain more accurate data on the amount of surplus vegetables available. The data obtained from a small group of volunteers is set out below and represents a preliminary effort to measure more accurately the potential available. The RETAIN project researchers were due to conclude their research in November 2025 but have been granted an extension until May 2026. They were unable to share any initial conclusions from their data as data collection and review was ongoing through winter 2025/6.

The following table provides data from two fields for carrots. While the volume cannot be extrapolated from this small sample size, it does show that for these two examples, the proportion of surplus that was still fit for human consumption represents the majority of what was left in the field (60% for Field A; 74% for Field B). Additional sampling is recommended to generate a better estimate of how much is left in the field and is suitable for consumption.

Name	Marketable (meets current buyer specifications)	Edible but not marketable (safe for consumption but no current market)	Not Edible/Spoiled
Field A	30% of the loss that falls into this category	30% of the loss that falls into this category	40% of the loss that falls into this category
Field B	49% of the loss that falls into this category	25% of the loss that falls into this category	26% of the loss that falls into this category
Average:	39.5%	27.5%	33%

Report 5 - Farm-Level Food Loss

Appendix 4 - Examples of Prevention through Valorisation and Secondary Markets

Country	Function	Name (hyperlink)	Description
Australia	Secondary market	Social Wholesaler Tasmania	State-wide social wholesaler for agencies to order produce below supermarket prices in development (secondary market B2B).
Canada	Secondary market	Local Line	E-commerce platform for farms and food hubs to sell online to consumers and buyers (secondary market B2C/B2B platform).
France	Secondary market	Bene Bono	Direct-to-consumer boxes of surplus/saved-from-waste produce (secondary market B2C).
Ireland	Valorising	BiaSol	Upcycles spent grain into nutritious food products (valorising).
Ireland	Valorising	Cream of the Crop Gelato	Uses surplus ingredients to make gelato and sorbets (valorising).
Ireland	Both valorising and secondary market	Meade Farm	Grower/packer with prepared foods and starch valorisation; secondary channels and processing (both).
Ireland	Secondary market	Open Food Network (Ireland)	Open-source platform enabling short supply chains; producers sell online; hubs/wholesale supported (secondary market B2C/B2B).
Ireland	Valorising	Rosetta Project - Vegetables of Gold	Research-led valorisation example creating new markets for edible surplus (valorising).

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Kenya	Secondary market	<u>Farm to Feed Kenya</u>	Aggregates imperfect/surplus produce from farmers and distributes to buyers and feeding programmes (secondary market B2B).
Netherlands	Both valorising and secondary market	<u>InstockMarket - Food Rescue Center</u>	Aggregates surplus from farmers/growers and supplies hospitality buyers; some processing (both; secondary market B2B + valorising).
Poland	Secondary market	<u>DeFood</u>	Agricultural exchange/wholesale channel with reduced prices for surplus/grade II produce (secondary market B2B).
Spain	Both valorising and secondary market	<u>Es-Imperfect</u>	Sells products made from imperfect fruit and veg; also, direct surplus offers (both; valorising + secondary market B2C).
Spain	Secondary market	<u>Freshis</u>	Connects local producers and consumers for rapid sale of fresh/surplus produce (secondary market B2C).
Spain	Secondary market	<u>Terra Pagesa (Barcelona)</u>	Short-supply chain linking farms to Barcelona buyers/markets (secondary market B2B).
United Kingdom	Both valorising and secondary market	<u>Ample & Ample Kitchen</u>	Ample sells surplus vegetables to consumers; Ample Kitchen produces meals/components from farm surplus (both; B2C + valorising for B2B).
United Kingdom	Secondary market	<u>FareShare Flex</u>	Platform for businesses to offer surplus for redistribution to charities (secondary market B2B/donation).

Report 5 - Farm-Level Food Loss

United Kingdom	Secondary market	<u>FoodChain</u>	Wholesale marketplace focused on local supply; can channel surplus but primarily procurement (secondary market B2B).
United Kingdom	Valorising	<u>Rubies in the Rubble</u>	Upcycles surplus fruit/veg into condiments (valorising; retail/foodservice).
United States	Valorising	<u>Harvesting Good</u>	Regional frozen processing of surplus vegetables using idle capacity (valorising).
United States	Valorising	<u>Maine Immigrant Greens Collaborative</u>	Partnership supplying culturally relevant greens via processing/aggregation (valorising/B2B to pantries).
United States	Valorising	<u>Upcycled Food Association</u>	Industry association advancing upcycling standards and markets (valorising ecosystem).

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Appendix 5 - FoodCloud Apple Gleaning Report

Dr. MaryAnne Hurley, Dr. Tracey O'Connor and Dr. Jennifer Attard (Circular Bioeconomy Research Group at Munster Technological University) and Nadine Snowling and Brian Curtin (FoodCloud), funded by the Department of Agriculture, Food and the Marine (January 2023)

FoodCloud Apple Gleaning Project



This report was produced by Dr. MaryAnne Hurley, Dr. Tracey O'Connor and Dr. Jennifer Attard (Circular Bioeconomy Research Group at Munster Technological University) and Nadine Snowling and Brian Curtin (FoodCloud), funded by the Department of Agriculture, Food and the Marine.

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Executive Summary

Context

The need for intervention to reduce food loss and waste (FLW) is widely recognized, e.g. the United Nations' Sustainable Development Goal 12. The goal to halve food waste by 2030 has been included in Ireland's Climate Action Plan (2019), and is supported by the National Food Waste Prevention Roadmap 2023-2025. Previous research carried out by FoodCloud and MTU in the "*Surplus Food Redistribution - An Opportunity to Reduce Farm Level Food Waste*" project found that almost four out of five farmers have edible surplus (77%), mainly due to produce not meeting retail specifications, and seasonal lack of consumer demand.

Purpose

The core objective of this study was to investigate the potential of gleaning surplus apples from commercial farms and redistributing them to charity and community groups. It also aimed to develop the business case for the production of FoodCloud Apple Juice from apples that would have normally been discarded. This study was carried out using 1) desk-based research involving interviews with, and surveys of, growers about their apple production, waste, and donation experience and 2) a pilot study of an apple gleaning initiative. This process resulted in the production of a Cloudy Apple Juice suitable for redistribution to charity and retail.

Key Findings

Twelve of the 34 active and contactable growers of the Irish Apple Growers' Association participated in the survey (35% response rate). Participants were diverse, producing dessert, cooking, and cider apples and apples for juice. Farm size ranged from 0.6-44.5 ha, and average apple production ranging from 10-1,400 tonnes. For one third of growers FLW was negligible, another third indicated that it was between 1-9% , and a further third experienced "moderate" FLW (10-24%). Overall, total apple FLW experienced by participating growers was in the range of 444–586 tonnes (36% pre-harvest, 64% post-harvest). Environmental and farm management factors resulted in FLW on all farms, e.g. pests, diseases, lack of storage capacity, shortage of labour. Retail standards and consumer preference also influenced FLW, e.g. small apple size, undesirable variety (e.g. Bramley), and the dominance of imported apples in the Irish market, suppressing native apple prices and creating an impression of "over-supply" of Irish apples¹.

Most farmers (92%) indicated that they did not usually have edible surplus, while 83% reported that all apples of saleable quality were sold. Apples not sold for fresh consumption were typically used for cider (during pressing season), juice or compost. Smaller operations tend to have limited storage infrastructure and aim to sell apples as fresh or for cider as quickly as possible. Larger-scale growers were more likely to have apple surplus outside cider pressing

¹ While growers referred to this as oversupply/lack of apple demand, the volume of apple imports to Ireland indicates that imported apples dominate, due to retailer or consumer preferences, or a combination of both.

season, coming from storage. Gleaning and surplus apple donation were of greater interest to larger-scale growers (>900 tonnes production), although these growers emphasised a need for more information, and provision of packaging by redistribution organisations. More collaboration is required between food redistribution organisations and apple growers in order to establish gleaning and donation partnerships, especially early in the year, in advance of harvest season.

This gleaning initiative yielded 4.5 tonnes of apples in total, 1.2 tonnes from gleaning events and 3.3 tonnes from donations of surplus apples. This produced 3,552 bottles (2,664L) of apple juice. Communication with non-commercial apple orchard owners proved fruitful, and represents an avenue for future gleaning collaboration, in addition to large-scale commercial growers.

Key Recommendations

This study identified a number of recommendations linked to apple FLW management challenges.

Apple FLW prevention

- Cooperative business models and greater collaboration among **growers** can add more value to apples, e.g. through collective storage facilities, coordinated labelling practices (e.g. “Irish apples”), or pursuing “Protected Designation of Origin”/“Protected Geographical Indication” for Irish/regional apples.
- **Policy-makers** can strengthen existing policies to promote FLW reduction, e.g. the Sustainable Horticulture Assurance Scheme could be used to promote producers with good performance, e.g. “gold standard”, similar to the Origin Green “gold standard” label for qualifying food businesses, which would add value to Irish apples for consumers.
- **Public bodies**, e.g. Bord Bia and Teagasc, can help growers to add value and reduce loss through development of the “Irish apple” brand, e.g. variety development, promotion campaigns.

Surplus apple redistribution

- **FoodCloud** should further evaluate opportunities to collect surplus from **non-commercial orchards** and continue to engage with **larger-scale commercial growers** to create fit-for-purpose methods to collect the apples, and raise awareness of production surplus redistribution initiatives and benefits among farmers.
- More **research** is required to establish the factors resulting in the dominant position of imported apples in the market, e.g. among **retailers** and **consumers**, in order to assess how Irish apples can gain a stronger market position, with implications for FLW reduction. Future research should be planned with sufficient time to take account of grower’s “busy periods”, e.g. harvest periods, and the ethics approval process, which can take a number of months.

1. Introduction

Food loss and waste continues to be a major global concern with approximately one third of food produced globally being wasted (Kummu *et al*, 2012). However, efforts to reduce global food waste and loss can create wider positive impacts. The United Nations' twelfth Sustainable Development Goal is focused on responsible consumption, setting a specific target related to reduction of food loss and waste (Target 12.3). However, it is also widely acknowledged that reducing food loss and waste can lower production costs, improve food security and nutrition, and decrease greenhouse gas (GHG) emissions - amongst other benefits for society, the environment and economic development (Fig. 1) (FAO, 2019).

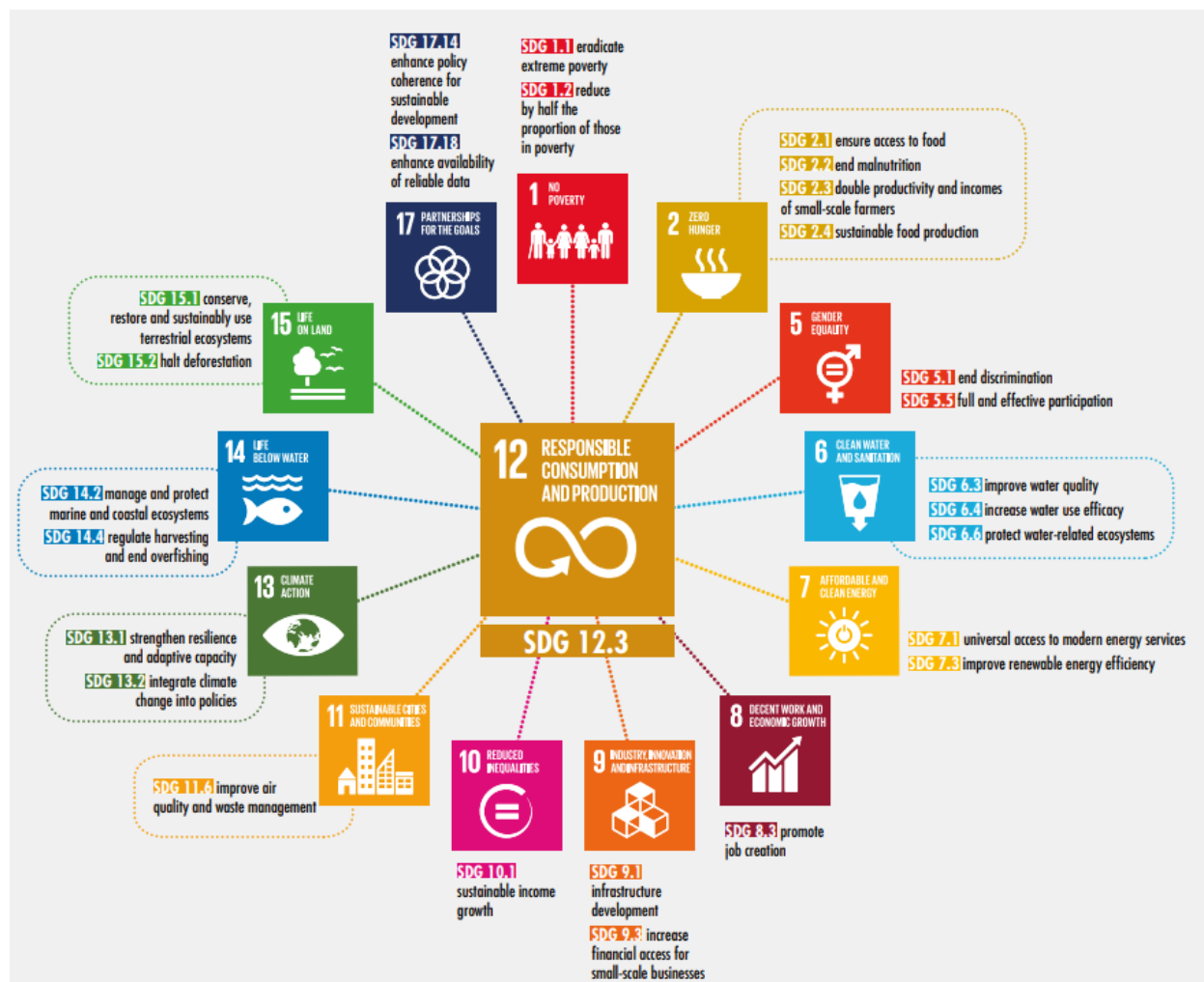


Figure 1: Food loss and waste, and the Sustainable Development Goals (FAO, 2019).

The European Union has also included food waste in the Waste Framework Directive with the

aim to halve food waste by 2030. The goal to halve food waste by 2030 has also been included in Ireland's Climate Action Plan (Government of Ireland, 2019), and is supported by the National Food Waste Prevention Roadmap 2023-2025 (Government of Ireland, 2022). The European Commission (2020) defines food loss as “a loss in potential food produced prior to the harvest of crops or animal products, including meat”, while food waste is “the loss of harvested food, before it can pass into the next stage of the supply chain”. This is referred to collectively in this document as Food Loss and Waste (FLW).

1.1 Food loss and waste in Irish apple production

In Ireland 770,300 tonnes of food are wasted annually, based on the reference year of 2020 (Environmental Protection Agency, 2022). Within the food production stage 189,485 tonnes of food are lost or wasted before the farm gate or at harbours (O'Connor, Kleemann & Attard, 2022). Fruit and vegetables are one of the highest contributors to food waste in the Irish primary production sector. An extensive study of FLW at primary production stage estimated 2,297 tonnes of apples are wasted per annum in Ireland, amounting to 16% of total apple production. Waste was largely due to storage rot and disease (15% of total production), primarily an issue among “fresh” apples, i.e. dessert and culinary apples, while pre-harvest rot and disease formed a minor part (0.6% of total production) and were the predominant FLW issue affecting apples destined for cider, juice and slicing (Attard & O'Connor, 2022).

Retail specifications can be an important source of surplus in fruit and vegetable production (Attard & O'Connor, 2022). The European Union (EU) has established minimum specification standards for fruit and vegetables generally, and some specific standards for particular types of fruit and vegetables, including apples based on food quality (e.g. free of pests), size (e.g. diameter, weight), and aesthetic standards (e.g. the extent of red colouring on apples) (European Commission, 2011). The EU standards for apples establish three grades of quality: Extra (highest quality), Grade I, and Grade II. Grade II apples are typically sent to processors at present, particularly cider and juice (Attard & O'Connor, 2022). Composting, animal feed and anaerobic digestion is an end use for apples not fit for cider production (Attard & O'Connor, 2022; MTU & FoodCloud, 2022). Growers have reported leaving apples unharvested due to lack of profitability in either “Extra”/“Grade I” retail, i.e. supermarkets/other food retail, and hotel, restaurant and catering sector or as Grade II/cider or other uses (MTU & FoodCloud, 2022). Unharvested apples are an ideal candidate for food waste prevention through redistribution, while surplus apples currently diverted to low nutritional value products, such as cider, could be diverted to other more nutritious products with moderate shelf-life compared to fresh apples, e.g. juice, slices, and puree.

1.1.1. Irish apple production context

Ireland is a temperate climate providing mild annual temperatures and adequate rainfall for year-round growth, a characteristic generally used by pasture-based farmers to their advantage (Drennan *et al.*, 2005; O'Mara *et al.*, 2012; Hurtado-Uria *et al.*, 2013). Mean air temperatures remain relatively constant throughout the year, ranging from 8 to 20°C in inland areas (Met Eireann, 2020). Rainfall in Ireland generally averages between 750 and 1400 mm/annum but is

generally dictated by location, with the West coast receiving the highest volume of rainfall and the East coast receiving the lowest rainfall (Met Eireann, 2020).

Commercial apple growing was introduced in Ireland within the last century, apple types including: eating, culinary and cider apples. The first attempt to encourage apple production on a commercial scale in Ireland was the 1903-1905 'fruit as a farm crop' scheme followed by the 'resident gentry's scheme', encouraging the new enterprises (Callaghan, 2020). However, decline occurred once joining the European Union in 1973, when tariffs were lifted from imported apples. The total apple production area in 2017 was 713ha (Bord Bia & DAFM, 2017), which represents a 16% increase from the previous census in 2012 (615ha). The dessert apple production area was up 75% from the 2012 census (from 122ha to 214 ha in 2017), reversing the downward trend that had been seen in previous years. The increase was partly attributed to new opportunities for dessert apples in juicing and cider markets. The culinary apple production area showed a 7% decrease since the previous census, while the cider apple production area increased by 15%. The National Apple Orchard Census 2017 identified 50 apple growers in Ireland, primarily producing culinary apples and eating/dessert apples, while the cider market held the majority marketplace for Irish apples in 2016 (Bord Bia & DAFM, 2017).

1.2 Food waste prevention and redistribution initiatives

Edible food which is at risk of disposal, also known as "food surplus" or "edible surplus", can be recovered and redistributed, for example via the charity sector, to support people experiencing food insecurity, malnutrition and social exclusion (Facchini *et al.*, 2018). If neither prevention nor redistribution is possible, value can be recovered from food waste through use as animal feed, and valorisation via conversion into energy through anaerobic digestion and biofertilizers through composting. These options are presented in order of preference, from a social, economic, and environmental perspective, in the "Food Waste Hierarchy", described in the European Union Waste Framework Directive to the specific context of food waste and similarly by the Environmental Protection Agency (European Commission Joint Research Centre, 2020, Environmental Protection Agency, 2022; see Fig. 2, below).

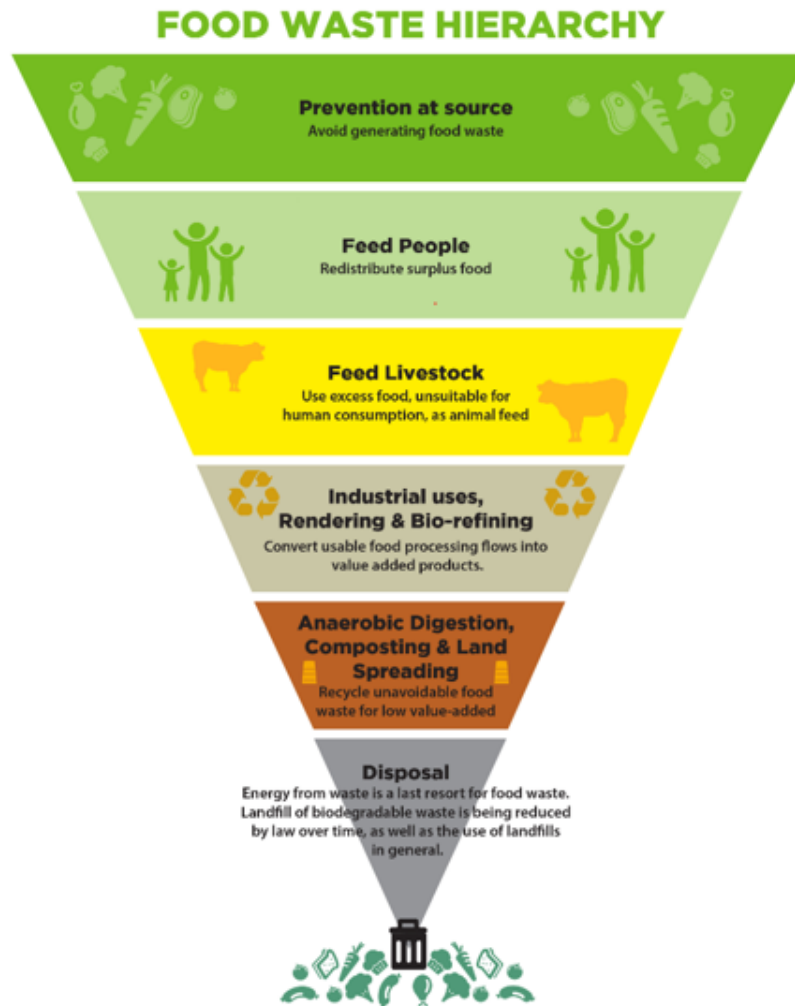


Figure 2: Food Waste Hierarchy (Environmental Protection Agency, 2022).

1.2.1 Food waste prevention and redistribution initiatives

The preferred food waste prevention actions described by the Food Waste Hierarchy require the involvement of different value chain actors, including government and regulatory bodies, consumers, retailers, processors, food redistribution organisations, and producers. This project focuses on two particular nodes in the value chain: producers, i.e. apple growers, and food redistribution organisations, and draws inspiration from food waste prevention actions typically associated with processors. Processor interventions include adding value to food by creating food ingredients and extending shelf-life. e.g. juicing. The use of “upcycled” ingredients in this way has also been leveraged by processors in their product stories and helped them attract consumers and establish a niche in otherwise crowded product categories, e.g. Cream of the Crop gelato (2022), sauces and jams from Rubies in the Rubble (2021), and baked goods from SUNT Food (2022).

At the producer level, FLW prevention interventions typically aim to reduce FLW before the farm gate/point of sale and so include all stages of production: sowing, animal rearing, harvest, packhouse grading, etc. FLW prevention at producer level has the twin logic of preventing food waste, and increasing production efficiency and profitability by achieving more of the output potential and achieving better value for products than if sent for animal feed/industrial use/anaerobic digestion. These interventions typically address producer practices and facilities, e.g. storage facilities, production sector challenges, e.g. availability of skilled workers, and value chain adjustments, e.g. shorter food supply chains (Attard & O'Connor, 2022). Other value chain adjustments include strengthening collaboration with other value chain actors, e.g. food redistribution organisations, food processors, to find new pathways for agricultural produce.

Food redistribution interventions aim to reduce food waste and increase food access for people experiencing food poverty. Interventions can take a business-to-consumer or business-to-business form, e.g. food-sharing platforms such as Olio (2022). Redistribution can also be mediated by social enterprises and charities, e.g. food redistribution organisations such as food banks (Global FoodBanking Network, 2022), FoodCloud (2022), and FareShare (UK) (2022), and charities with a food service, such as Cork Penny Dinners (2021) and Foodshare Kerry (2022). Interventions to redistribute surplus food to people in this way include surplus supermarkets and community “food pantries” or fridges where people can pick out food for free, e.g. OzHarvest Market (2022), and surplus kitchens and community-spaces offering free or low-cost meals prepared from surplus food, e.g. FoodBank Australia (2020) and InStock (2022).

There are three main types of food redistribution interventions: a) “traditional”, uncompensated donation of food surplus to food redistribution organisations and charities; b) donation of food surplus to food redistribution organisations and charities, with compensation of part or all of the grower’s costs of donation; and c) food redistribution organisations and charities enter the “market” to redirect food surplus from non-food applications to consumers. The latter two options encourage greater donation of food at producer-level, helping to address FLW at the beginning of the food supply chain and increasing the availability of fresh food for charities.

1.2.1.1 Traditional donation

Traditional food donation, whereby farmers donate food without receiving direct compensation, has existed for a long time. This contributes to food redistribution, including in Ireland, e.g. to food redistribution organisations such as FoodCloud (2022), or charities, such as Cork Penny Dinners (2021).

1.2.1.2 Compensated donation

Producers are compensated for donations in two main ways, where these programmes exist: compensation via tax deductions, and direct compensation, e.g. for the costs of production. Tax-deductible donations or tax credits are an option for agricultural producers in a number of countries, e.g. Canada, Colombia, France, Spain, and the US (Vittuari *et al.*, 2016; Kinach, Parizeau & Fraser, 2020; ABACO, 2020; Feeding America, 2017). In this way, food redistribution organisations can collect surplus from farmers directly, and farmers receive compensation

through the state. A few different actors can be involved, e.g. in Colombia, the “Recovery of Agricultural Surpluses” (REAGRO) programme of NGO ABACO aggregates farmers’ surplus through the food bank network, and manage logistics, while farmers receive compensation through tax deductions for their donations (ABACO, 2020). While tax-deductible charitable donations of a monetary nature are enabled in Ireland through the “Charitable Donation Scheme”, material goods such as agricultural products are not eligible for a tax deduction or tax credit (Revenue, 2022). The existing donations policy could be adapted to recognise the value of “benefit-in-kind” donations, e.g. grade II food surplus, valued by volume donated.

Direct compensation is an approach that has been tried by other food redistribution organisations. In 2019, UK-based food redistribution organisation FareShare launched a £3 million “Surplus with Purpose” fund with support from the UK Department for Environment, Food and Rural Affairs (FareShare, 2022). This fund covers the costs of food recovery for farmers, including costs of production, storage and transport, as well as other food supply chain actors, up to a maximum of £50,000. FoodCloud has piloted this approach in the Surplus Food Redistribution project 2021-2022 and found that while it functioned, there were some challenges associated with differences in horticulture sector scale and coordination between Ireland and the United Kingdom (MTU & FoodCloud, 2022). Other strategies are now being developed by FoodCloud to develop an approach to compensated donation and redistribution of farm-level surplus that is a good fit for the Irish fruit and vegetable production context. This apple gleaning project is one such initiative.

1.2.1.3 Gleaning

Gleaning is an ancient tradition, where leftover crops are collected from farmers’ fields. Initially, this was done by peasants, with landowners allowing them to collect any scraps left behind from the harvest as depicted by Jean Francois-Millet’s famous painting, *The Gleaners*. More recently, gleaning has become a method of food recovery where individuals volunteer their time to collect surplus food - either unharvested food or food left behind by commercial harvesters (Marshman & Scott, 2019).

FoodCloud has been gleaning since 2017, bringing volunteers to collect high-quality crops by hand including potatoes, onions, carrots and broccoli, which are then donated to their network of community groups and charity partners. In Ireland, Falling Fruit (2022) has been harvesting local fruit (including apples, pears, plums, nuts) from private residences across Dublin and donating them to local charities. Across Europe, there are many other examples of volunteers gleaning as a way to redistribute food to those in need. In Nantes, France, Re-Bon uses a network of volunteers who use their own car to travel to the farms and redistribute the food (Re-Bon, 2022). In 2015, the Gleaning Network EU completed a feasibility study across organisations in Belgium, France, Greece and Spain which recovered 29,571 kg of food across 82 gleaning days (Woolley, Martin & Charlesworth, 2015).

1.2.1.4 Market-based approach

In a market-based approach food redistribution organisations purchase food that meets their needs from conventional markets at an appropriate price for the quality offered. This may differ

from that accepted by retailers, e.g. accepting grade II produce at a fair price. This approach was taken in the US as part of the “Coronavirus Food Assistance” programme from 2020-2021 (USDA, 2021). The US Department of Agriculture “Farmers to Families Food Box” programme provided funds to regional and local food redistribution organisations, e.g. City Harvest NYC (2022), to purchase food directly from farmers and other food suppliers. Food redistribution organisations packed the food into family-sized boxes for delivery to food banks and other charities providing a food support service. This approach has not been attempted by Irish food redistribution organisations yet, although some organisations providing a low-cost meals service in Ireland, e.g. Meals on Wheels, buy produce directly from farmers on demand and according to their own specifications (Personal communication, 2021).

1.3 Aims and objectives of this research project

This project seeks to address food waste due to surplus apples in the commercial apple production sector, through gleaning by volunteer groups, and redistributing them to charity and community groups and for retail sale. This project proposes a hybrid approach between compensated donation, as implemented in the “*Surplus Food Redistribution - An Opportunity to Reduce Farm Level Food Waste*” (Surplus Food Redistribution) project (MTU & FoodCloud, 2022), and gleaning, as implemented by FoodCloud for other crops, e.g. potato, and within Falling Fruit Ireland. The research will also incorporate aspects of processor-style solutions for prolonging food shelf-life and improving logistics and storage ease, i.e. juicing. The research will develop the business case for the production of apple juice from apples that would have normally been discarded. It will simultaneously address two important societal issues: food poverty and food waste and aims to improve and increase the nutritional value of food accessible to our most vulnerable community members. In order to achieve the above aims, the project will 1) develop an overview of food waste and donation experience in the Irish apple sector, 2) develop and pilot a hybrid compensated gleaning solution to address food waste in the apple sector through a food processing approach (juicing), and 3) assess the market size of apple juice. This research will support FoodCloud’s work in developing solutions to farm-level food waste with community volunteer groups.

2. Methodology

This study was funded by the Department of Food, Agriculture and the Marine. The study was carried out using four principal methods:

1. desk-based research involving interviews with, and surveys of, apple farmers about their food waste, as well as market research to understand the state of the apple juice industry in Ireland (MTU; see section 2.1);
2. a pilot trial of volunteer led apple picks (FoodCloud; see section 2.2);
3. development of the apple juice product (FoodCloud; see section 2.3);

4. distribution of the Cloud Apple Juice to retailers and charity partners (FoodCloud; see section 2.4).

Through this work, innovative solutions will be developed, in collaboration with the project partner, FoodCloud, to ensure that the maximum amount of edible surplus is being redistributed to people, through a pilot study of “gleaning” of 2 days duration on approximately 3 apple farms.

2.1. Desk-based research

An initial literature review was carried out to understand the Irish apple loss and waste context (June–September 2022). A survey instrument previously applied to analyse FLW and food redistribution potential in the horticulture sector was adapted for the apple production sector. The source survey instrument was completed by 31 Irish fruit and vegetable farmers in 2021, including three apple growers (MTU & FoodCloud, 2022). The adapted survey (see Appendix) was reviewed by the two research team members with experience of Irish primary production FLW research, two FoodCloud members with extensive experience of food surplus redistribution, gleaning, and FoodCloud operations, and the chairperson of the Irish Apple Growers Association (IAGA). The aim of the survey was to understand the current state of FLW, and food redistribution potential of the apple sector in Ireland.

The IAGA is the largest association of apple growers in Ireland, and with 49 members represents the majority of Irish apple growers². Between August 17th 2022 and November 10th 2022, the survey was circulated via email to the 49 members of the IAGA, by their chairperson. Follow-up reminder emails were issued by the IAGA chairperson and subsequently the research team. Apple growers were invited to participate in follow-up phone call interviews rather than the online survey, to facilitate greater opportunity to take part in the study. The survey results were subsequently analysed. Where growers responded with a value range, e.g. 10–19ha, the mid-point between the lower and upper ends of the range was taken as the representative value for those growers. The survey research allowed the identification of loss and waste in the Irish apple sector and current food donation practices.

2.1.1 Market research

A review of available literature was conducted, including scientific literature and grey literature regarding the domestic market for apples, including juice. Sector experts from Bord Bia, Teagasc, and the IAGA were consulted through interview and email correspondence. This information was combined with the knowledge shared by apple growers during the survey, and the literature review to understand the apple market, in particular for juice. An estimate of the market size for native Irish apple juice was developed on the basis of this information, in addition to identification of alternative market and policy interventions for value addition to surplus apples.

² To put this in context, the Bord Bia and DAFM National Apple Orchard Census 2017 identified 50 commercial growers active in Ireland at that time, and there has not been a substantial increase in production since then

2.2. Pilot trial

During the survey process, any growers who indicated interest in participating in the pilot trial were passed on to FoodCloud for a follow-up discussion. From there, FoodCloud worked with the growers to organise volunteer-led pick days. Additional research was conducted to identify alternative pick locations through desk-based research. FoodCloud compiled a list of 202 different locations across the country which may have orchards or apple trees on site. This included: stately homes, OPW sites, parks, wedding venues, hotels, etc. Each was contacted at least once by email and phone where the information was available. Once the locations were identified, FoodCloud leveraged their existing network of corporate and community volunteers, to complete the picks. Picks were conducted during the month of October 2022, with FoodCloud arranging all logistics associated with the work (volunteer communication, picking materials, apple transport). All picked apples were stored in the FoodCloud Hub in Dublin before being transported to the juicing location (The Apple Farm, Tipperary) by FoodCloud.

2.3 Apple Juice Production and Label Creation

The apples were pressed into juice by the Apple Farm, Tipperary, who have been growing fruit since the 1960s and pressing juice on-site since 1995. The Apple Farm was responsible for pressing, bottling and labelling the juice, using a label created by FoodCloud. The label was created alongside an external designer.

2.4 Apple Juice Distribution

The pressed juice was returned to the FoodCloud hub to be stored and distributed to retailers (70%) and FoodCloud charity partners (30%). The retail partners chosen for distribution after the end of the project will be informed by the market research, as well as utilising existing retail partners such as GIY, and Airfield Estate.

3. Survey Results and Market Research

An online survey was circulated among the IAGA, a group of forty-nine commercial Irish apple growers. IAGA members were also given the option of completing the survey by phone. The IAGA is believed to represent the majority of Irish apple growers (see section 2.1). Of the 49 IAGA members, 15 were unsuitable candidates due to having retired from growing apples commercially (7), or having incorrect or missing contact details (8). Twelve of the remaining 34 eligible growers³ participated in the survey (35% response rate). Two opted to not participate as they perceived themselves unsuitable to represent commercial Irish apple growers (6%). A further 12 farmers agreed via email to answer the survey online but ultimately never answered, while another farmer indicated that they were too busy to answer (38% collectively). Three farmers completed the survey online (25%), with nine farmers (75%) preferring to give their

³ Active and contactable.

information over the phone. A sum of 137 phone calls and 260 emails were made over a 2 month period, between August 17th to November 10th. The seasonal workload burden on farmers during harvest months was evident from the survey, and responses to emails and phone calls, and it is believed that this impacted farmers' capacity to fill in the survey.

Growers from nine different counties participated in the survey (Fig. 3): four from Waterford, one each from Cork, Dublin, Kilkenny, Laois, Louth, Mayo, Meath, and Tipperary, broadly reflecting the areas of greatest apple cultivation in Ireland (Bord Bia & DAFM, 2017).

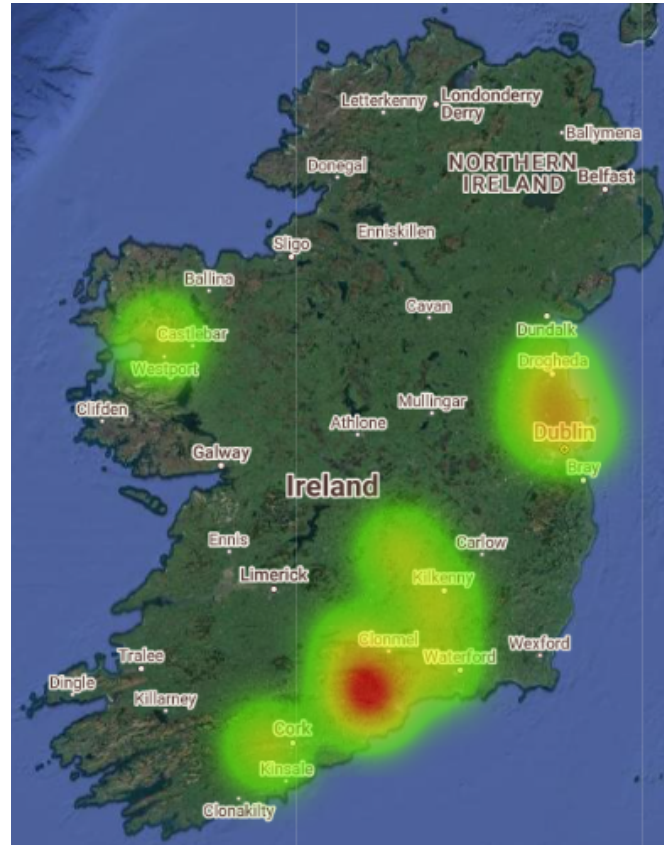


Figure 3: Heatmap displaying approximate locations of participating apple farms (n = 12).

3.1 Apple production

The average farm size was 17.8 ha, ranging from 0.6 to 44.5 ha⁴ in size. The total orchard area covered by this study was 212 ha, representing 31% of the total Irish apple production area in 2021 (710ha; Eurostat, 2022). The average amount of apples grown per farm was 590 tonnes, ranging from 10 to 1,400 tonnes of apples per farm. Collectively, the production of growers was 7,083 tonnes, representing 45% of the total Irish apple production volume in 2021 (15,860

⁴ Representing the midpoint between “40-49 ha” which was provided as the greatest orchard size.

tonnes; Eurostat, 2022). Most of this production (81%) took place on five farms, almost all of which were between 20-49 ha in size, while the remaining 19% was produced by farms of less than 20 ha in size. The average yield was 22 tonnes/ha⁵, with a highly variable range of 3-41 tonnes/ha. Farms larger than 8 ha and with production volumes of at least 350 tonnes had greater yields (33-41 tonnes/ha), while farms of smaller size, lower production volume and those specialising in juice or cider all had lower yields, predominantly in the range of 3-10 tonnes/ha. These findings highlight differences in apple production intensity on Irish farms, with larger, higher volume enterprises having more intensive production strategies than smaller or lower volume counterparts, and those farms focused on apples for processing into juice and cider. The findings also demonstrate that a diverse range of growers participated in the study. The collective data concerning apple volume and production area, i.e. that 45% of national apple volume is produced on 31% of national apple production area, reflects the findings of the 2017 national apple orchard census that the majority of apple production was concentrated on a small number of orchards⁶ (Bord Bia & DAFM, 2017).

Apple harvest typically takes place between September and November, with cider apples harvested later in the season. The majority of growers surveyed only had one full time worker, being the business owner, highlighting the seasonal nature and small scale of Irish apple farms. Growers who were more focused on producing apples for cider described the ease and low workload associated with this, compared to growing for other production types. For example, cider apples could be picked from the ground with a machine rather than depending on people to hand pick the fruit. Due to the seasonal production of the apples and short harvest time, and thus short period of labour demand, staff were difficult to retain.

3.2 Apple uses

Most farms produced apples for various purposes. By volume, those included cooking/culinary apples (49%), eating/dessert apples (33%), cider apples (11%) and apples for juicing (7%). By comparison the 2017 national apple production census found that 52% were used for cider, 31.4% as cooking/culinary apples, 10% as eating/dessert apples, 4.4% for juice and 2.4% for slicing/puree (Bord Bia & DAFM, 2017), while one third of apple acreage is dedicated to cider apple varieties (Callaghan, 2020), indicating that cider producers may be under-represented in this study. Two growers produced apples for cider purposes only, while one juiced all of their apples. Growers emphasised that eating apples were the most economically valuable if demand was strong. Growers emphasised annual variability in demand for eating apples, influenced by annual production volumes which can create a shortfall or surplus of supply, and strengthen or depress prices. Factors such as orchard age, apple tree variety, demand for type of apple and labour availability at harvest all played a role in the market opportunities available for apples. Out-graded apples from both dessert and culinary apple production are used to make cider and juice, and cider is a suitable use for windfalls and dropped apples. Growers indicated that the craft cider segment of the Irish cider sector has seen small growth in recent years, and tends to

⁵ Excluding those growers who indicated a production range in their survey response (25% of growers).

⁶ The largest 10 orchards accounted for 65% of apple production, the next largest 15 orchards accounted for 24% of production, and the remaining 25 orchards accounted for 11% of production.

use more Irish apples than bigger brands (which typically use greater amounts of apple concentrate). However, overall volume increases have been small.

3.3 Apple losses and waste

Farmers were surveyed on production losses pre-harvest (losses) and post-harvest (waste). Overall, total apple losses of participating growers were in the range of 444-586 tonnes, with a midpoint estimate of 515 tonnes. Pre-harvest loss accounted for 36% of losses, with an estimated range of 155-220 tonnes, while post-harvest losses (waste) accounted for 64% of losses, with an estimated range of 289-366 tonnes (Fig. 5). One of the reasons why apple producers experienced relatively low levels of FLW is the range of apple quality accepted by cider manufacturers. Many growers emphasised they had little to no storage infrastructure on farms, thus selling low quality apples directly to cider companies or for juice was very attractive, especially for those located close to cider manufacturers.

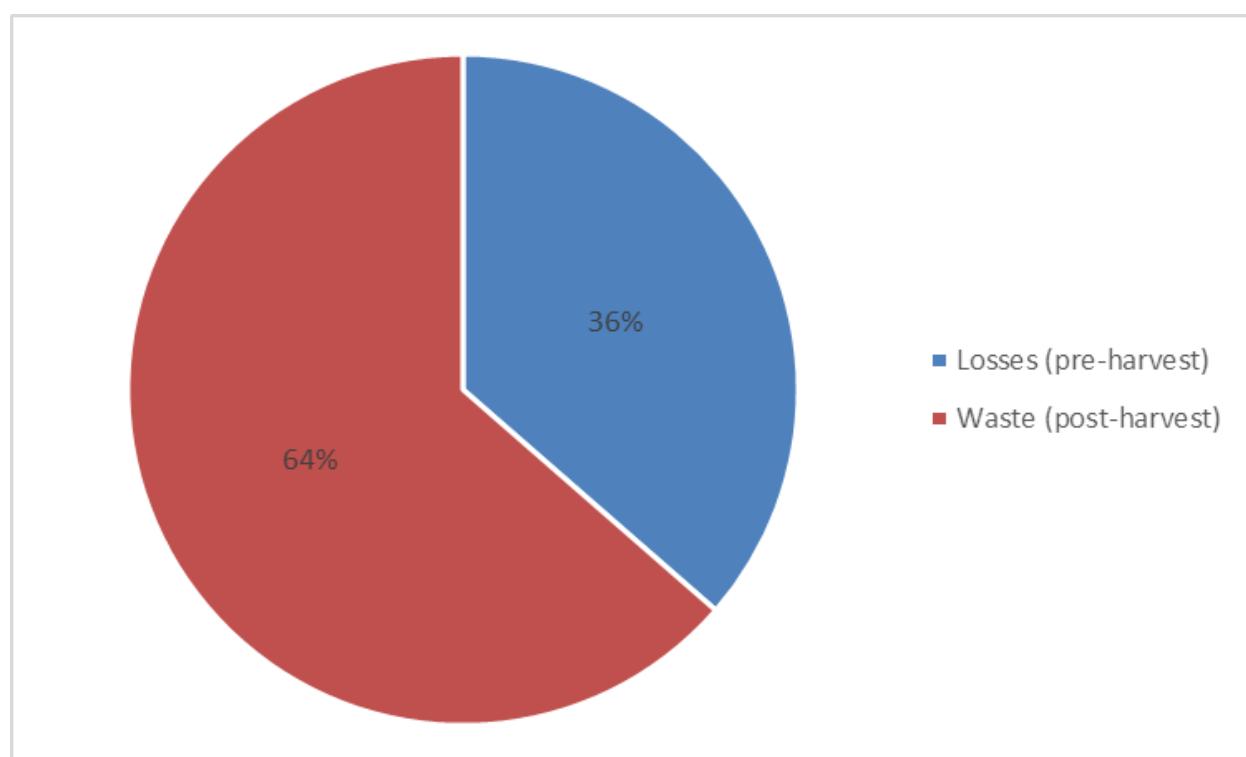


Figure 5. Production losses and waste that occurred pre-harvest (losses) and post-harvest (waste), as a proportion of total production volume (n = 12).

On an individual basis, one third of growers reported negligible loss and waste, one third experienced “low” loss and waste (between 1-9% lost/wasted) and the final third experienced “moderate” levels of loss and waste (between 10-24% lost/wasted). This is relatively low compared with other crops in the horticulture sector generally, as described in the Surplus Food Redistribution project, which saw losses as high as 50% (MTU & FoodCloud, 2022), and reflects what was described for apple production in the study of Attard and O’Connor (2022). Most losses were experienced by two types of farms: those with relatively low production (3-99

tonnes) and those with relatively high production (at least 600 tonnes). Waste was predominantly experienced by farms with relatively high production volumes (at least 900 tonnes). The proportion of losses and waste experienced by farmers is reported in Table 1.

Table 1: Percentage of growers reporting proportion of apples lost pre-harvest, post-harvest (waste), and in total (n = 12).

Proportion of crop typically lost	Nil/ negligible (<1%)	Low (1-9%)	Moderate (10-24%)
Pre-harvest losses	33%	42%	25%
Post-harvest losses (waste)	50%	33%	8%
Total apple loss and waste	33%	33%	33%

3.3.1 Losses (pre-harvest)

Farmers described that weather and ground conditions in a particular year impacted pre-harvest losses, e.g. windfalls of unripened fruit due to adverse weather, and the likelihood of disease. All growers experienced losses due to pest damage (from less than 1% up to 10%), disease damage, pre-harvest dropping and windfalls, and deliberate dropping during harvest, e.g. due to small size or immaturity. Of these, windfalls resulted in the most losses, although growers indicated that a return on these apples could be achieved if sold to cider producers. Pest damage, e.g. due to bird damage, and disease damage was typically negligible. The events least likely to cause pre-harvest losses of apple crop were accidental dropping during harvest and not harvesting saleable apples, affecting 25% and 8% of growers, respectively (Table 2). These losses typically occurred on farms of larger scale (at least 900 tonnes of production), which may suggest greater emphasis on quality rather than volume on these farms, compared with those of smaller scale.

Table 2: Number and proportion of growers affected by known causes of pre-harvest loss, and the proportion of production typically lost as a result (n = 12).

Reasons for pre-harvest loss	Growers affected (%)	Proportion of production lost
Pest damage	12 (100%)	<1% - 10%
Disease damage	12 (100%)	<1% - 10%
Dropped/windfalls	12 (100%)	1% - 10%
Harvest: Dropped deliberately	12 (100%)	1% - 5%
Harvest: Dropped accidentally	3 (25%)	1% - 5%
Un-harvested but saleable	1 (8%)	1% - 2%

Although only one grower reported leaving apples un-harvested, seven growers described why apples might not be harvested. The main reason provided for not harvesting apples was poor price or low demand, e.g. due to oversupply or apples being a less preferred variety such as Bramley (cooking) apples (four growers). Other reasons included apples not being sufficient quality for fresh sales (two growers), a lack of storage capacity, a shortage of labour, and apples being affected by disease.

3.3.2 Waste (post-harvest losses)

All apple growers reported 1-2% waste of harvested apples due to damage that occurred during storage, even those who sold apples immediately after harvest due to a lack of storage facilities. For three quarters of growers, 1-10% of harvested apples were lost due to diseases that developed during storage. A quarter of growers lost less than 1% up to 5% of harvested apples due to deterioration during storage. Most growers (83%) reported that all apples of saleable quality were sold. However, half of growers experienced challenges with selling harvested apples, including four of those who indicated that all apples were eventually sold. For three growers this was a minor issue (less than 1% up to 2%), while for the other three the proportion of apples that were difficult to sell was in the range of 6-10% of harvested apples. Factors contributing to difficulty selling apples included the price offered, market preference for other varieties of apple, and the small size of the apples. The causes of waste included in the survey were primarily experienced by larger farms with higher levels of production (at least 900 tonnes),

which may reflect the tendency of smaller farms to avoid storage and sell apples as soon as possible instead.

3.3.3 Edible apple surplus

Most farmers (92%) indicated that they did not usually have edible surplus, i.e. unsold or unharvested apples that would not be edible without further processing. This suggests that there is limited availability of edible surplus apples and good market opportunities already available to apple growers. For example, three growers typically processed unsold apples of saleable quality for juice. One grower used unsold apples of saleable quality for compost, while another grower indicated that 1-2% of apples were left unharvested if prices offered were poor. Both of these scenarios suggest the presence of edible surplus, even though the farmers concerned did not classify them as such.

Surplus apples were most likely to occur during harvest in October, with slightly less likelihood in September and least likelihood in November. Growers reported varying shelf-life for edible surplus apples. A third of growers reported a shelf-life of less than one month for surplus apples, while a further third indicated that surplus apples could last a number of months, ranging from 4 months up to 12 months in one case. The wide range of shelf-life likely reflects the lack of storage on many farms and the quality of apples that would end up as surplus, e.g. Grade II apples. Growers were not asked to describe their farm infrastructure in detail during this survey, but from these results it may be an interesting topic to pursue in the future.

Seven of the 12 farmers who completed the survey shared the price received for edible surplus/grade II apples. Growers received a range of prices, from €100-750/tonne, with price varying depending on the market and variety. Eating apples received the highest price and cider apples the lowest. Apple growers also indicated that prices for surplus apples were influenced by market conditions within a given year, i.e. Irish apple supply and demand. One farmer reported the price was much lower in 2022 compared with 2021, as supply was high after the warm summer, which depressed prices. Removing the outlier value of €750/tonne (offered for surplus eating apples), the average price received by farmers was €185/tonne. This compares favourably with prices offered for other surplus fruit and vegetables. A previous study found that prices ranged from €5-200/tonne for fruit and vegetable surplus generally, with a higher price point of €150/tonne offered for surplus that was suitable for food processing, e.g. juicing (MTU & FoodCloud, 2022). Nonetheless, this might not be sufficient to offset the costs of production. The Surplus Food Redistribution project (FoodCloud & MTU, 2022) found that €440/tonne was required on average to cover the cost of horticulture production (based on five growers and nine crop types), with a higher cost of €610/tonne reported for apples (one grower).

3.5 Experience of donating apples

One third of growers had donated apples in the past, mostly growers with larger scale farms (at least 900 tonnes production), who reported experiencing some level of loss and waste, including those with unharvested apples and who typically experienced challenges in selling a portion of their apples. Donations were made post-harvest, from the packhouse or farm and ranged from a

few pallets once a year, to monthly donations of Grade II apples. The largest amount donated was 5% of production, equivalent to approximately 50 tonnes. One grower indicated that they had used “Too Good To Go” to donate apples in the past.

Three of the growers with larger-scale farms indicated that they might consider donating apples in the future. Four growers, including those three, provided information about the notice period they might be able to give to food redistribution organisations about apples available for donation, primarily those with larger scale farms (at least 900 tonnes). This ranged from 5-7 days to more than a week. A number of issues concerning donating food were identified by these four growers. For example, it needed to be more clear that donations are needed, e.g. charities should request donations directly, and food redistribution organisations would need to provide their own packaging. One felt that food donation was unsustainable for both food producers, and donation recipients, as it does not address the simultaneous systemic issues of food poverty and the low value prices paid to food producers. For another grower, the organisation concerned would be an influential factor in their decision to donate, and there would need to be a clear understanding of the quality of produce being donated, e.g. Grade II/seconds. It was also the case that growers did not have consistent levels of surplus that could be donated, but that sometimes surplus might be available, e.g. outside of cider pressing season and with varieties that are not suitable for juice, e.g. Bramley.

A number of the surveyed growers (42%) discussed the notice period that they would be able to provide to gleaning groups, ranging from 2–3 days to more than a week. These were growers with at least 350 tonnes of production. Four growers discussed gleaning opportunities with FoodCloud but that did not result in gleaning partnerships during this project.

3.7 Apple Juice Market

As described in the survey results, most growers surveyed produced apples for eating, culinary and cider purposes. One of the 12 surveyed growers produced apples for juice only, while a third of farmers sold a portion of apples for juice, ranging from 1–20% of their otherwise unsold apples. Unsold harvested apples are those most appropriate for redistribution as juice, while pre-harvest apples that could be salvaged and would be suitable for gleaning include apples not harvested due to poor return on investment. Prices for surplus ranged from €100-750/tonne, and excluding the high outlier of €750/tonne (surplus eating apples), the average price received by growers for surplus produce was €185/tonne.

Ireland is home to some large Irish juice brands, e.g. Mulrine’s (Kulana, Juice Press, Jaffa Gold), McCann’s. A number of apple growers produce their own juice for sale locally, e.g. farmers markets and delicatessens/craft food stores, direct sales. Retail prices range from €1.69/L, which is competitive with imports such as Squeez, to €6/L for organic, farm-based “craft” juices (Table 3). The average price for Irish native apple juice, of brands considered, was €3.16/L, and this average would be higher if focusing on “craft” juices alone (€4.62).

Table 3: Price range of native Irish juices, sold through major retail outlets (Aldi, Tesco, Supervalu, Dunnes Stores) and farm websites/craft food stores. Prices valid as of 09.12.2022, accessed through online sources.

Brand	Price/L	Characteristics	Reference
McCann's Harvest Juices	€3.93	Farm pressed, glass bottle (750ml)	behansfruitandveg.ie/product/mccann-harvest-juices/
Supervalu/Dunnes Stores Irish pressed	€2.00	Bulk pressed, plastic bottle (1L)	https://shop.supervalu.ie/shopping/drinks-apple-juice-supervalu-irish-1-l-/p-1774066000 ; https://www.dunnesstoresgrocery.com/sm/delivery/rsid/445/product/dunnes-stores-pressed-irish-apple-juice-1l-100875582
Kulana	1.69	Bulk pressed, Tetra Pak (1L)	https://www.tesco.ie/groceries/en-IE/products/305366739
Aldi cloudy Irish	2.39	Bulk pressed, cloudy, plastic bottle (1L)	https://groceries.aldi.ie/en-GB/ALDIIE/p-irish-pressed-apple-juice-1l-specially-selected/4088600124322
Juice Press	2.19	Bulk pressed, Tetra Pak (1L)	https://shop.supervalu.ie/shopping/drinks-apple-juice-press-not-from-concentrateapple-juice-irish-1-l-/p-1065642000
Apple Farm	3.99	Farm-pressed, glass bottle (750ml)	https://www.theapplefarm.com/onlineshop.htm
Clashganny	5.93	Organic, farm-pressed, single variety, glass bottle (750ml)	https://www.ardkeen.com/products/clashganny-100-irish-organic-apple-juice-750ml

3.7.1 Native Irish juice demand and market size

Ireland's population in 2022 is estimated to be 5.1 million (CSO, 2022). Bord Bia established in 2016 that 9.8% of Irish people typically consume shop-bought juice as part of breakfast, amounting to approximately 501,594 consumers in 2022 (Bord Bia Insight Centre, 2016; CSO,

2022). Juice is also considered a relatively healthy snack, and juice consumption is rising in Ireland (Bord Bia Insight Centre, 2018; Bord Bia Thinking House, 2020). Juice also forms parts of children’s snacks, although there are concerns about the sugar content of juices and negative implications for health, especially dental health, compared to whole fruit (O’Connor, Walton & Flynn, 2016).

The Irish Health Service Executive (HSE) recommends that people should limit juice consumption to a single 150ml serving per day (Healthy Ireland, 2016). However consumer perceptions of a single serving size can vary, with smaller servings (50-120ml) recommended for children (O’Connor *et al.*, 2016), while single serving juice carton volumes indicate variation between 125-250ml, e.g. 200ml cartons of Kulana juice, 150ml cartons of Innocent juice. Accounting for an approximate serving size, based on the variation in the 125-250ml/day range, this suggests Irish demand of 34.3 million litres of juice per annum (Table 4).

Local, minimally processed foods produced with consideration for sustainability, e.g. waste reduction, are increasingly attractive factors for consumer choice. Inclusion of rescued food can be part of the sustainable production story of food products, helping to make these products attractive to consumers, e.g. as with Cream of the Crop ice cream, and Rubies in the Rubble sauce range. There are distinct differences between the local and high sustainability credential juice segment, and the conventional, bulk-produced segment, with opportunities for producers to profit from the former through farmers markets, direct sales, and branding. This has been successfully demonstrated by farmers and food processors in Florida, whose use of the terms “Florida oranges” and “Fresh from Florida” add value to both fresh and processed products, e.g. juice (Martinez *et al.*, 2010). Irish farmers have also demonstrated success with similar approaches, e.g. “Wexford strawberries”, “Irish beef”.

Four growers participating in this study indicated that a portion of their apples (1-20%) is used for juice, while another grower juiced all of their apples. Overall, this amounted to 7% of overall production of surveyed growers, almost 3% more than in the 2017 Irish apple production census (Bord Bia & DAFM, 2017). Assuming that 7% is a nationally representative estimate of native juice production, this equates to 1,110 tonnes of apples used for juice nationally. The production achieved in the pilot was 3,552 bottles of 750 ml each, totalling 2,664 litres, from 4.2 tonnes of gleaned surplus (see Section 4 for more detail). This is a ratio of 634L juice/tonne apples. On this basis, native apple juice production can be considered to be equivalent to 704,057 litres/annum. This is 2% of the 34.3 million litre national juice demand (Table 4).

Table 4: Calculation of market size for native Irish apple juice, based on published data, survey results (n = 12) and correspondence with sector experts (n = 3).

National juice market		Native juice market estimates (based on growers’ juice production):	
Juice consumers (9.8% of population) (CSO,	501,594	Native apple juice consumers	102,88

2022; Bord Bia, 2016)			
Approximate juice serving size per day (Healthy Ireland 2016; O'Connor <i>et al.</i> , 2016; retailer pack sizes)	188ml/day (0.19L/day)	Daily native apple juice consumption	1,929 L/day
Annual juice consumption (million L)	34.32	Annual native apple juice production (L) (survey results)	704,057
		Native apple juice market share of national juice market	2%

The 2,664 litres of gleaned apple juice produced in this project is equivalent to 0.4% native apple juice market share, a small fraction of the market. Considering the survey data about availability of surplus apples, few growers had pre-harvest surplus suitable for gleaning, with just one of the 12 growers indicating that a portion (1–2%) of apples might remain unharvested due to low price or lack of labour, among other reasons. This surplus could be suitable for gleaning. For this grower, these unharvested apples accounted for ~ 15 tonnes, approximately 0.2% of the total production of the surveyed apple growers. Extrapolating this to national production, this type of surplus could amount to 34 tonnes of gleaned apples. The 34 additional tonnes from gleaned surplus could increase gleaned juice production to 24,230L juice/annum. This would be equivalent to a 3% share of the native apple juice market estimated in Table 4, above. These calculations are shown below in Table 5. The relatively low interest of growers in apple gleaning described in section 3.5, and challenges in establishing gleaning partnerships experienced during this project (described in section 4), indicates that achieving this level of production is unlikely. A best case scenario is therefore probably closer to <1% of native apple juice market share.

Table 5: Calculation of market size for gleaned apple juice (within native Irish apple juice market), based on published data, survey results (n = 12) and correspondence with sector experts (n = 3).

Pilot project outcomes		Additional surplus (identified in survey)	
Annual native apple	704,057	Apples from	34

juice production (L) (survey data)		unharvested orchards (~ 0.2% national production based on Eurostat (2022) and survey data in this study) (tonnes)	
Project production 2022 (L)	2,664	Juice from unharvested orchards (as above) (L)	21,566
Native apple juice market share of 2022 gleaned apple juice	0.4%	Gleaned apple juice potential (2022 production + apples from unharvested commercial orchards) (L)	24,230
		Native apple juice market share of gleaned apple juice potential (2022 production + apples from unharvested commercial orchards)	3%

3.7.2 Other market opportunities for rescued Irish apples

Alternative beverages that achieve other consumer “goals”, e.g. vitamin intake/nutraceuticals, or that provide other value, e.g. fruit cordials that capture the flavour of juice with less sugar, and pre-prepared mocktails and other novel flavour pairings, can have added value over traditional non-alcoholic beverages (Bord Bia Thinking House, 2019). Apples are recognised as a fruit that contains different bioactive molecules, including vitamins, minerals, polyphenols, and polar lipids, e.g. omega 3 fatty acids, with health benefits such as probiotic, anti-platelet and anti-inflammatory properties (Tsoupras *et al.*, 2021). In at least some cases these are accessible through consumption of the juice product, as well as through consumption of the whole fruit, although juice consumption is also associated with negative health factors such as tooth decay and high sugar content (O'Connor, Watson & Flynn, 2016). Opportunities that preserve the positive health attributes associated with apples, e.g. slices and puree/apple sauce could also be valuable to explore. Commercial apple puree/apple sauce is a stronger product in other countries, e.g. USA where it makes up 20% of canned fruit consumption (Buzby *et al.*, 2008). Irish consumers traditionally make apple sauce at home rather than purchasing it from retailers. However, the presence of apple sauce in retail outlets is growing, e.g. Folláin Irish apple sauce

in major supermarkets, and may continue to grow with consumer interest in plant-based, low-fat and/or low-sugar recipes which can substitute fruit purees, e.g. bananas or apple sauce for eggs, fats such as butter and/or sugar (Hayek & Ibrahim, 2013).

4. Pilot

4.1 Introduction

The pilot part of this project was inspired by FoodCloud's previous experience gleaning vegetables and Falling Fruit Ireland's experience harvesting fruit across Dublin. The pilot involved selecting commercial fruit farmers to allow volunteers to glean any surplus fruit from their orchards. Using FoodCloud's existing corporate volunteer network and with support from Falling Fruit volunteers, the pilot would take place over two consecutive days across three selected farms. The total volume of apples gleaned during these events would be transported to the Apple Farm to be pressed into apple juice. The pressed juice would be labelled and bottled to be sold by FoodCloud (70%) and distributed to our charity partners (30%).

4.2 Pilot Logistics

4.2.1 Gleaning Locations

Following the completion of the Apple Grower survey, only four growers indicated interest in participating in the pilot study. When contacted, they were not able to commit to the project this year citing being too busy at the time of contact (close to the harvest period)⁷. FoodCloud began investigating alternative locations, to understand if there was still a possibility to glean elsewhere. A list was compiled using online sources of 202 different locations across the country which may have orchards or apple trees on site. This included: stately homes, OPW sites, parks, wedding venues, hotels, etc. Each was contacted at least once by email and phone where the information was available. Of the 52% who responded, 39% showed potential interest in participating. Of those who may be interested, 6% indicated that they would participate if the apples were still on the trees by the date the volunteers arrived, 22% were uncertain and needed to check with a decision maker, and 10% indicated that their apples had already fallen or been picked but would be interested in participating next year. By the time this research was completed (September 2022), all apples from the locations who had shown interest in participating had fallen, or been picked, leading FoodCloud to find an alternative option to secure locations.

FoodCloud has received apple donations for many years from Falling Fruit Ireland, a Dublin-based urban harvesting project that collects unpicked fruit from private homes in Co. Dublin. Falling Fruit had already sourced locations for gleaning in Dublin but supported FoodCloud with finding locations for the pilot project through their network. In collaboration with

⁷ However, these growers might be able to participate if contacted earlier in the year.

Falling Fruit, FoodCloud found five locations where the owners agreed to participate in the pilot. The orchards contact Falling Fruit directly to offer their orchards, as the fruit would otherwise go unpicked. Falling Fruit would normally turn down the locations further outside of Dublin, as their volunteer base would not be able to travel to the locations. The orchards were located in (See Fig. 6 for geographical spread):

- Bushy Park, Galway
- Terryglass, Tipperary
- Townley Hall, Louth
- UCD, Dublin
- Russborough House, Wicklow



Figure 6: Apple pick locations across the country, alongside locations of FoodCloud Hubs.

Each location was within a 1.5 hour drive from either the FoodCloud hub in Galway or that in Dublin, which helped decrease transport costs. The locations all had 20+ trees for picking, which is considered suitable for the proposed volunteer group sizes.

Initially, the intention was to consolidate all of the picks across two days but once the locations were confirmed, this was determined to be impossible. Each grower identified different ideal picking dates based on the weather and state of the crop, which meant that 4 dates were chosen across October 2022.

4.2.2 Volunteers

Early on, FoodCloud identified one existing corporate partner as the ideal volunteer partner for this project. As FoodCloud's largest corporate volunteer partner, previous conversations indicated that they wanted additional opportunities for their staff outside of Dublin, but in practice

the rural locations ended up being challenging to recruit for, due to the dispersed nature of their workforce outside of Dublin.

Through this corporate partner, 45 volunteers were recruited for the scheduled pick at UCD. The location made it most convenient for participants and accessible by public transport. Falling Fruit supported FoodCloud with not only their expertise, but also some of their long term volunteers to the days in Russborough House, Townley Hall and UCD. UCD was the most accessible location for the majority of their workforce.

4.3 Pilot Impact

4.3.1 Pilot Trial Outcomes

Across the five scheduled pick days, only two went ahead as planned, with 1,280kg apples gleaned by 23 volunteers (See Figure 7). The scheduled pick at Bushy Park, was unable to go forward as the location was secured at the last minute and the apples fell before the scheduled picking date. The Terryglass location was cancelled as there was limited volunteer sign up due to the rural nature of the location. Finally, the UCD location did not go forward on the scheduled date. Due to weather conditions only a few days ahead of the scheduled event, the apples were ready to fall and picked by the team at UCD. Ultimately, we still received the apples from this pick but the organised volunteers did not pick the apples. A summary of this is shown below in Table 6.

Table 6: Showing a summary of apple picking days and volumes collected.

Location	Date	Volunteers	Volume Collected
Russborough House	October 10 2022	8	520 kg
Bushy Park, Galway	October 14 2022	0	0
Townley Hall	October 20 2022	15	760 kg
Terryglass	October 20 2022	0	0
UCD	October 27 2022	45	720 kg

In addition to the above picks, Falling Fruit contributed 500 kg of apples picked from assorted picks at private homes. Con Traas of the Apple Farm also made a 2000 kg donation of apples to add to the amount gleaned. In total, 4,500kg of apples were sent to be pressed.



Figure 7: Images of volunteers collecting apples from Russborough House.

4.3.2 Apple Juice Pressing and Logistics

All transportation and logistics were managed by FoodCloud, including transport of apples from the orchards and storage in the Dublin Hub. FoodCloud consolidated the apples into three main transports from Dublin to the Apple Farm, keeping in mind the freshness of the apples but also keeping costs down. Three hundred kg of rotten apples were removed from the pressing, leaving 4,200 kg of apples to be pressed which yielded 3,552 bottles of juice.

FoodCloud's internal Communications team worked together with an external designer to create the label, with a focus on highlighting the story behind the juice (Fig 8). The front label mentioned: where the apples were from, how they were picked and that they would have otherwise been wasted. The back label goes into further detail of how the apples were picked as well as describing the tradition of gleaning. A barcode was added to ensure the product would be easy to sell in retail locations.



Figure 8: Apple Juice labels created by FoodCloud.

4.3.3 Apple Juice Distribution

Of the 4,500 kg of apples sent for pressing, producing 3,552 bottles of 750 ml. These were transferred back to the FoodCloud Dublin hub over two transfers in October and November 2022. The bottles are now being stored in the warehouse with a Best Before Date of December 2023. The juice was pasteurised, to extend the life of the juice from a few days to over a year. See image of bottle below, Figure 9.



Figure 9: Image of FoodCloud's Cloudy Apple Juice.

30% of the bottles produced will be donated to FoodCloud's partner charities and community groups to be used for consumption. The 70% leftover will be retailed to create a sustainable income stream to reinvest in FoodCloud's charitable mission. FoodCloud sold 330 bottles from the first pressing in the FoodCloud Kitchen. This new initiative from FoodCloud is Ireland's First Zero Waste Food Truck, which travels to corporate events and community food festivals to create meals using surplus food.

As determined by the Market Research in section 3.7, FoodCloud's Cloud Apple Juice will make up a small share in the native apple juice market. The retail distribution of the juice will focus heavily on the product story, highlighting the product's consideration for sustainability. Ultimately, the unique selling point of the product is that the juice was made by hand-picked Irish apples that would otherwise have gone to waste. This will place the juice in the local and high sustainability credential juice segment, sitting amongst other "craft" juices.

With this in mind, the recommended resale price (RRP) of this product will sit above the average price of juice per litre. Taking into account the cost per bottle of approximately €2.24 and other similar products on the market (average €4.62/L, see section 3.7), the RRP will be €6 per bottle and the wholesale price will be €4 per bottle. FoodCloud will source retailers selling similar products, mostly those with a focus on local, sustainable or "craft" products such as: Dublin Food Coop (<https://dublinfood.coop/>), Noms (<https://noms.ie/>), and Small Changes (<https://www.smallchanges.ie/>). FoodCloud will continue selling juice directly through the FoodCloud Food Truck and also retailers who have collaborated in the past, such as GIY (<https://giy.ie/>) and Airfield Estate (<https://www.airfield.ie/>).

4.3.4 Project KPIs

The project was just short of achieving the main key performance indicators associated with this project, as demonstrated in Table 4 below. However, a substantial amount of fruit that would have otherwise been wasted was recovered and used to create FoodCloud's Cloudy Apple Juice.

Table 7: Overview of all project KPIs as determined by tender application and the actual achieved

KPI	Goal	Actual
Number of surveyed apple growers	20-40	34 viable contacts - 12 surveyed
Number of participating producers	3-5	5 private orchards
Number. of community volunteers	30	23
Number. of corporate volunteers	40	45
Volume of food rescued	6 tonnes	4.5 tonnes

Volume of apple juice produced (750 ml bottles)	6,000	3,552
Number. of recipient charities	300 of our network of 700 charities will have access to this	To be confirmed on complete distribution
Number. of participating retailers	6-8	3 to date
GHG emissions saved by preventing apple waste	19,200kg	14,400kgs (1kg food = 3.2kg CO ₂) ⁸

4.3.5 Pilot Financial Review

The total direct costs to FoodCloud to operationally deliver the pilot project amounted to €7,959.29. This creates a cost per bottle of €3.71. The FoodCloud costs include the project management associated with establishing the pilot and other indirect costs to deliver FoodCloud's core services.

5. Conclusions

This study involved a range of growers of diverse farm size, production volume and yields, which can be considered an indicator of production intensity. Thirty-four growers from the IAGA were found to be eligible for this study (commercially active and contactable by email/phone), of which 35% participated. A few relatively large-scale growers participated in the study, as indicated by the collective land area and production volume of survey participants. Participating growers produced almost half of national production on 31% of national apple growing area, with most of that explained by five growers who accounted for 81% of the apple production recorded in the survey. This reflects the findings of previous studies concerning Irish apple production, which found that the majority of apple production takes place on a relatively small number of farms. For example, the largest orchard owner in Ireland, juice producer Mulrines, owns 16.5% of the apple producing area of Ireland (Mulrines, 2018). Cider producers are likely to be under-represented in this study, based on comparison with prior Irish studies. Cider apples are less at risk of waste compared with other apple varieties, as marginal quality and windfall/dropped apples can be used for cider production, thus the under-representation of cider producers may have resulted in

⁸ To calculate equivalent CO₂-eq. avoided, FoodCloud applies a conversion factor of 1kg = 3.2kg CO₂-eq saved. The calculation is based on the average CO₂-eq emissions of the different food categories that can be redistributed by FoodCloud. This figure was verified by KPMG and indicates that it provides a conservative estimate of environmental impact.

over-estimation of national apple loss and waste volumes.

Apple producers experienced low to moderate levels of FLW, compared with other types of horticulture production. Losses and waste typically occurred on larger farms with greater production volumes. All growers reported losses and waste as a result of environmental and farm management factors, e.g. pests, diseases. Survey findings suggest that apple growers are affected by retailer specifications and consumer demand, although the impact is not as strong as that experienced by other horticulture growers. This is likely due to the wide range of apple type and quality accepted by cider producers. Apple growers indicated a problem with “over-supply” resulting in losses (e.g. unharvested apples) and waste (e.g. deterioration in storage). However, in the context of Ireland importing 66,000 tonnes of apples in 2020, more than three times the national apple production in that year (Eurostat, 2022; CSO 2021), it is clear that retailer/consumer preference for imported apples, rather than apple over-production, is a driver of the “over-supply” problem. Other market criteria, e.g. small apple size and apple variety made it challenging for some growers to sell apples, e.g. if this criteria came into play outside cider pressing season.

The price paid for surplus apples compares favourably with that paid for other types of crop, although it still may not be sufficient to compensate for the cost of production. Growers emphasised that due to a lack of on-farm infrastructure, e.g. storage facilities, they are limited in how they can manage apples that are not sold immediately after harvest, resulting in a large amount of Grade II/surplus apples being sold for cider. Growers indicated that the cider market is very attractive to them as it is not as labour-intensive as harvesting apples for fresh consumption and all apple types are accepted.

5.1 Apple donation and gleaning

Four growers expressed an interest in gleaning. A gleaning collaboration was not possible with the interested growers this year, but further collaboration with growers earlier in the year could help to develop gleaning partnerships in the future. Another grower indicated that 1-2% of apples were typically unharvested, which could be a suitable source for gleaning. The time window for coordinating gleaning events was narrow, with farmers indicating that they could provide 2-3 days to more than a week’s notice to gleaning groups.

Four growers had donated apples in the past, all of which were post-harvest donations. Three growers indicated that they would be interested in donating apples in the future. However, growers indicated that they would need to know that there was demand for donations, and that the food redistribution organisation would need to provide their own logistics. All of the growers interested in gleaning or donation were those with larger-scale production (at least 350 tonnes, and generally more than 900 tonnes). These are also the growers that tend to experience greater levels of apple waste, suggesting that future donation-seeking and gleaning partnerships are most likely to be successful with larger-scale farms. Earlier collaboration with growers in the future could help to evaluate if currently inedible losses, e.g. due to rot and disease, could be salvaged before the crop reaches that point of deterioration, and if harvest-time dropping of apples could be salvaged, e.g. through gleaning. The responses to the survey and low level of

interest of farmers in both gleaning and compensated donation, even among those with unharvested apples, suggest that the concept of compensated donation and gleaning are not familiar to growers. This aligns with the results of the FoodCloud and MTU Surplus Food Redistribution project, and international findings about farmer awareness of food waste interventions (Bonadonna *et al.*, 2019) and underlines the need for further collaboration between food redistribution organisations and farmers and awareness-raising about what compensated donation and gleaning involve and the potential benefits for farmers, e.g. added income.

5.1.1 Market for juice from gleaned apples

This project successfully identified and collected surplus apples for juicing, mostly through donation, resulting in production of 2,664L of juice⁹. This amounts to 0.4% of the national native juice market. There may be potential to grow this to 3% of the native juice market, based on reported unharvested orchards. Average apple juice prices are estimated to be €3.16/L, although juices with additional sustainability credentials (single farm, zero plastic, organic) retail at a higher price: €4.60/L on average. The value proposition of salvaging apples at risk of waste must be sufficient for farmers as well as the recovery organisation, e.g. FoodCloud, to attract their engagement, e.g. through financial compensation that covers the cost of harvest or any administrative cost associated with hosting gleaning volunteers. A governance structure other than the proposed compensated donation approach, that can facilitate greater value return to farmers for salvaged apples, could achieve a more clear value proposition, e.g. a juice cooperative. Other food products can also be investigated for adding value, especially in markets where individual farms do not hold a strong stake (avoiding competition with grower-producers), e.g. apple sauce, baby food, concentrates such as cordial. Other value-added opportunities could be explored by farmers, e.g. the IAGA, to address inedible waste, e.g. composition analysis of apple components for application to other industries, e.g. nutraceuticals.

5.2 Impact and future viability of the project

The finding of the programme demonstrates there is limited scope with the commercial growers to glean surplus apples for redistribution to FoodCloud. There is a need for greater awareness of the benefits of surplus redistribution to charities which needs to be led by industry and support farmers addressing their FLW targets. Earlier collaboration and intervention with commercial farmers is recommended. There is a greater opportunity with private orchards which have more flexibility and less distribution channels.

All apples gleaned for the production of the apple juice were gleaned from private orchards, rather than from commercial growers, as their apples would be left unused and had greater incentive to find alternative uses. While the survey indicated limited edible surplus as part of the farmer's total harvest, it is still FLW and could be used as food for those in need. In order to access this surplus in future, grower contact would need to occur outside of the harvest season with more notice. In addition, a different method to organise apple collection would be advisable, as there were significant challenges associated with organising logistics relating to the volunteer

⁹ 3,552 X 750ml bottles of juice.

led apple picks, due to the small picking window and the crops being susceptible to weather conditions. Ultimately, this proved challenging when organising corporate and community volunteers who needed up to one month notice (if not more) to coordinate their availability for the picks. In addition, private growers had less knowledge of their own crop and were less able to predict the ideal picking window to choose an appropriate date for the volunteers to glean. In addition, it seems that most of the edible surplus is already off the tree, leaving none for the volunteers to pick.

A potential opportunity that was identified through this project, was the amount of unpicked apples unused in private apple orchards across the country. As identified by Falling Fruit in the Dublin region, there are significant opportunities in private orchards which are smaller and more appropriate to be gleaned by volunteer groups. As Falling Fruit currently operates solely in Dublin, there is an opportunity to begin sourcing private orchards in other areas of the country.

6. Recommendations

6.1 Recommendations for apple growers

- Apple growers experience relatively low levels of loss and waste compared with other horticulture producers, and can proudly highlight this as an indication of the sustainability of their sector. To enhance value addition, growers can also pursue strategies to promote the local attribute of Irish apples, e.g. through growing a “club” apple variety, pursuing “Protected Designation of Origin” or “Protected Geographical Indication” for Irish or regional apples (e.g. “Armagh Bramley” (TasteAtlas, 2023)), and identifying apples as “Irish apples” in addition to variety and grower indications, in order to make Irish apples a more readily identifiable brand for consumers.
- A lack of storage facilities was one of the reasons why substantial amounts of Grade II produce are sold for cider. We recommend that apple growers investigate cooperative business models that can facilitate greater value addition opportunities for Irish apples. Examples of cooperative business models include producer cooperatives but also those that can operate in parallel to existing private ownership business models, e.g. machinery cooperatives that can facilitate co-ownership of juicing equipment, or product-focused cooperatives, e.g. juicing or other longer shelf-life products. For example, cooperatively owned cold storage in regions with higher apple production such as Waterford, Tipperary and Kilkenny, could help growers achieve stronger market prices for Grade II apples by providing a longer timeframe for apple sales, and incentivise collection of apples that might otherwise have low value and be left on trees. Other associated benefits include increasing the utility of apples produced, avoiding waste, e.g. unharvested apples, and incentivising investment in maintaining and developing apple orchards, including attracting younger growers.

6.2 Recommendations for FoodCloud

- It is recommended that to see this project scale, FoodCloud must engage with commercial farmers earlier in the year to identify opportunities to collaborate, e.g. to evaluate if currently inedible losses could be salvaged before the crop reaches that point of deterioration. Following this preliminary work, FoodCloud can then create fit-for-purpose methods to collect the apples, not necessarily relying on gleaning as the main method.
- The findings indicate low awareness among growers about compensated donation and gleaning. More awareness-raising, e.g. with the IAGA and producer support organisations such as Teagasc and Bord Bia, about what compensated donation and gleaning involve, and their benefits for farmers can also achieve greater redistribution of surplus apples arising at the production stage.
- FoodCloud should complete research to determine opportunities to collect surplus from private orchards, not only relying on commercial surplus. Future work with commercial growers should focus on larger-scale growers, as these growers are more likely to experience food loss and waste, and to have an interest in donation or gleaning.
- It is recommended that FoodCloud also investigate alternative ways to engage with private growers, such as that of the [Kirkby Fruit Project](#) in North Yorkshire, England. Apples are not only picked by volunteers, but also donated by individuals with trees in their homes and for each 5kg donated they receive one bottle of juice in return. This encourages community engagement and education of the importance of limiting food waste, but also lessens logistics associated with volunteers needing to pick the apples.

6.3 Recommendations for research on primary production food surplus

- More research is required to establish the factors resulting in the dominant position of imported apples in the market, e.g. among retailers and consumers, in order to assess how Irish apples can gain a stronger market position. This has implications for FLW reduction, and the domestic apple sector, which in addition to food provision provides benefits for social, economic and ecological sustainability, e.g. food security, rural job creation and rural development, carbon sequestration, and with appropriate management can support biodiversity.
- Research should be designed with a view to achieving the highest possible rates of participation, in order to fairly represent the sector(s) concerned. This may include phone call interviews, as these have been demonstrated to be more attractive to Irish producers than online surveys, Zoom interviews, etc. due to the flexibility of this method (no appointment/meeting link required, can participate while driving, walking in a farm yard, etc.). Research on apple growers (and other specific production sectors) should be planned with the production operations and harvest schedule in mind so as not to be in conflict with busy periods of activity for growers. This includes planning sufficient time for ethical review of data collection instruments and methods (approximately three months).

- This project had support from the IAGA and the IAGA contributed to the project design. However, participation was still limited, indicating that support from trusted “gatekeeper” organisations and individuals was not enough to demonstrate the value of this research for participants. To try to achieve higher rates of participation, more growers could be included in the research design stage of similar future research, e.g. through a design phase workshop, in order to ensure the relevance of research for their objectives. This would have the added benefit of raising awareness about key concepts to this type of pilot project and research, e.g. food surplus and compensated donation (see recommendations in section 6.1).

6.4 Recommendations for policy-makers

- Bord Bia’s existing Sustainable Horticulture Assurance Scheme (SHAS) can be strengthened to help apple growers support sustainability claims and strengthen their capacity to utilise surplus. Actions that can be taken include linking SHAS compliance and additional performance criteria to horticulture advisory services to help provide targeted advice, e.g. for minimising crop losses and waste, and enabling producers to achieve a “gold standard”¹⁰ or similar communication tool to easily communicate their SHAS performance to consumers. Public agencies can build on the success of other fruit growers, e.g. Florida orange growers and Pink Lady apple growers to help strengthen consumer knowledge and appreciation of Irish apples through stronger promotion of the local attributes of Irish apples (e.g. through Bord Bia), and development of locally associated “club” apple varieties (e.g. through Teagasc). A new census of Irish apple production would also support the sustainable development of the apple sector and food loss and waste reduction, as the findings from this survey suggest a number of changes have occurred since the most recent edition (2017), e.g. reduction in number of apple-growers, increase in native apple juice market.
- Incentives to encourage utilisation of marginal apples, e.g. through processing into value-added products on a private enterprise or cooperative basis, including food products (juice, apple sauce, etc.), food ingredients (e.g. apple pomace), and nutraceuticals can help growers add more value to marginal quality apples and improve the value proposition for food loss and waste reduction. Other incentives that can be explored to promote redistribution of food surplus include incorporation of food donations as part of tax-deductible donations in the “Charitable Donations Scheme”.

¹⁰ Similar to that of Origin Green, which is beyond the scope of many apple growers due to turnover <€100,000.

7. References

ABACO (2020) Reagro. Available at: <https://abaco.org.co/reagro/> (Accessed: December 28, 2022)

Attard, J. & T. O'Connor (2022) Food Loss and Waste from Farming, Fishing and Aquaculture in Ireland. Environmental Protection Agency, Wexford, Ireland.
<https://www.epa.ie/publications/research/waste/research-410--food-loss-and-waste-from-farming-fishing-and-aquaculture-in-ireland.php>

Bonadonna, A., Matozzo, A., Giachino, C. & G. Peira (2019) Farmer behavior and perception regarding food waste and unsold food *British Food Journal* 121:1:89-103.
<https://doi.org/10.1108/BFJ-12-2017-0727>

Bord Bia & DAFM (2017) National Apple Orchard Census 2017. Bord Bia, Dublin, Ireland; DAFM, Celbridge, Ireland.
<https://www.bordbia.ie/globalassets/bordbia.ie/industry/irish-sector-profiles/horticulture-censuses/national-apple-orchard-census-2017.pdf>

Bord Bia Insight Centre (2016) Consumer insight into the breakfast occasion in Republic of Ireland and Great Britain [Presentation] Bord Bia. April 2016.

Bord Bia Insight Centre (2018) Healthy Snacking UK and Ireland [Presentation] Bord Bia. January 2018.
<https://www.bordbia.ie/globalassets/bordbia2020/industry/insights/consumer-insights/healthy-snacking-uk-and-ireland-january-2018.pdf>

Bord Bia Thinking House (2019) The Bord Bia Functional Food & Beverage Innovation Playbook 2019 [Presentation] Bord Bia. June 2019.
<https://www.bordbia.ie/globalassets/bordbia2020/industry/insights/consumer-insights/functional-food-and-beverage-innovation-playbook-june-2019.pdf>

Bord Bia Thinking House (2020) Fresh Produce Study [Presentation] Bord Bia. July 2020.
<https://www.bordbia.ie/globalassets/bordbia2020/industry/insights/consumer-insights/fresh-produce-report-july2020.pdf>

Buzby, J.C., Biing-Hwan L., Hodan F.W., Lucier G., & A. Perez (2008) *Canned Fruit and Vegetable Consumption in the United States*. Report to Congress, US Department of Agriculture, Economic Research Service, September 2008.

Callaghan, D. (2020) Commercial Apple Production Factsheet, Teagasc Horticulture Development Department, Ashdown, Dublin 15. Available at:
<https://www.teagasc.ie/media/website/rural-economy/rural-development/diversification/3---Comm>

[ercial-Apple-Production.pdf](#) (Accessed: December 1, 2022)

City Harvest (2022) City Harvest. Available at: <https://www.cityharvest.org/> (Accessed: December 29, 2022)

Cork Penny Dinners (2021) Cork Penny Dinners. Available at: <http://corkpennydinners.ie/> (Accessed: December 29, 2022)

Cream Of The Crop Gelato (2022) Cream Of The Crop Gelato. Available at: <https://creamofthecropgelato.com/> (Accessed: December 29, 2022)

CSO (2021) Ireland's Trade in Goods 2020. Available at: <https://www.cso.ie/en/releasesandpublications/ep/p-ti/irelandstradeingoods2020/food/> (Accessed: January 3, 2023)

CSO (2022) Census of Population 2022 - Preliminary Results. Available at: <https://www.cso.ie/en/releasesandpublications/ep/p-cpr/censusofpopulation2022-preliminaryresults/> (Accessed: January 2, 2023)

Drennan, M.J., Carson, A.F. & S. Crosse (2005). Overview of animal production from pastures in Ireland. In: *Utilisation of grazed grass in temperate animal systems: proceedings of a satellite workshop of the XXth International Grassland Congress, Cork, Ireland* (pp. 19-35).

Environmental Protection Agency (2022) Food Waste Statistics for Ireland. Available at: <https://www.epa.ie/our-services/monitoring--assessment/waste/national-waste-statistics/food/> (Accessed: December 28, 2022)

European Commission (2011) Commission Implementing Regulation (EU) No. 543/2011. Brussels: European Commission. [https://www.fsai.ie/uploadedFiles/Consol_Reg_543_2011\(1\).pdf](https://www.fsai.ie/uploadedFiles/Consol_Reg_543_2011(1).pdf).

European Commission (2020) Guidance on Reporting of Data on Food Waste and Food Waste Prevention. https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+food+waste+reporting/5581b0a2-b09e-adc0-4e0a-b20062dfe564_

European Commission Joint Research Centre (2020) Brief on food waste in the European Union. Italy. https://joint-research-centre.ec.europa.eu/publications/brief-food-waste-european-union_en

Eurostat (2022) Crop production in national humidity. Luxembourg: European Commission. https://ec.europa.eu/eurostat/databrowser/view/APRO_CPNH1_custom_4281364/default/table?lang=en

Facchini, E., Iacovidou, E., Gronow, J. & N. Voulvoulis (2018) Food Flows in the United Kingdom: The Potential of Surplus Food Redistribution to Reduce Waste. *Journal of the Air and Waste Management Association* 68:9:887–99.

https://doi.org/10.1080/10962247.2017.1405854/SUPPL_FILE/UAWM_A_1405854_SM6535.DOCX.

Falling Fruit (2022) Urban Harvesting Project Available at: <https://www.fallingfruit.ie/> (Accessed: December 29, 2022)

FAO (2019) The State of Food and Agriculture 2019. Moving Forward on Food Loss and Waste Reduction. United Nations Food and Agriculture Organization, Rome, Italy.
<https://www.fao.org/3/ca6030en/ca6030en.pdf>

FareShare (2022) About the FareShare Surplus With Purpose Fund. Available at: <https://fareshare.org.uk/giving-food/about-the-fareshare-surplus-with-purpose-fund/> (Accessed: December 29, 2022)

Feeding America (2017) Six Regional Produce Cooperatives Established. Available at: <https://www.feedingamerica.org/about-us/press-room/produce-cooperatives> (Accessed: December 29, 2022)

FoodBank Australia (2020) 250,000 Community Kitchen Meals in Western Australia. Available at: <https://www.foodbank.org.au/250000-community-kitchen-meals/?state=au> (Accessed: December 29, 2022)

FoodCloud (2022) FoodCloud: Food Waste Hurts Our Planet. Available at: <https://food.cloud/> (Accessed: December 29, 2022)

FoodShare Kerry (2022) FoodShare Kerry: Spreading surplus, reducing waste. Available at: <http://fsk.ie/> (Accessed: December 29, 2022)

Global FoodBanking Network (2022) Home - The Global FoodBanking Network. Available at: <https://www.foodbanking.org/> (Accessed: December 29, 2022)

Government of Ireland (2019) Climate Action Plan 2019. Dublin.
<https://www.gov.ie/pdf/?file=https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf#page=null>.

Government of Ireland (2022) Ireland's National Food Waste Prevention Roadmap 2023-2025. Dublin.

Hayek, S., & S. Ibrahim (2013) Consumer acceptability of chocolate chip cookies using applesauce as a fat (butter) substitute. *Emirates Journal of Food and Agriculture* 25:3:159-168.
<https://doi.org/https://doi.org/10.9755/ejfa.v25i3.10828>.

Healthy Ireland (2016) Your guide to Vegetables, salad and fruit. Available at: <https://www2.hse.ie/documents/169/vegetables-salad-and-fruit-fact-sheet.pdf> (Accessed: January 3, 2023)

Hurtado-Uria, C., Hennessy, D., Shalloo, L., O'Connor, D. & L. Delaby (2013) Relationships between meteorological data and grass growth over time in the south of Ireland. *Irish Geography* 46:3:175-201.

Instock (2022) Restaurant Instock Zet Voedselverspilling Op de Kaart. Available at: <https://www.instock.nl/> (Accessed: December 29, 2022)

Kinach, L., Parizeau, K. & E.D.G. Fraser (2020) Do Food Donation Tax Credits for Farmers Address Food Loss/Waste and Food Insecurity? A Case Study from Ontario. *Agriculture and Human Values* 37: 383–96 <https://doi.org/10.1007/s10460-019-09995-2>.

Kirkby fruit project (2022) Surplus fruit. Available at: <https://kirkbyfruitproject.com/donating-fruit/> (Accessed: December 18, 2022)

Kummu, M., De Moel, H., Porkka, M., Siebert, S., Varis, O. & P.J. Ward (2012) Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Science of the total environment* 438:477-489.

Marshman, J. & S. Scott (2019) Gleaning in the 21st century: Urban food recovery and community food security in Ontario, Canada. *Canadian Food Studies* 6:1:100-119 <https://canadianfoodstudies.uwaterloo.ca/index.php/cfs/article/view/264/311>

Martinez, S.W., Hand, M.S., Da Pra, M., Pollack, S.L., Ralston, K.L., Smith, T.A., Vogel, S.J., Clark, S., Lohr, L., Low, S.A. & C. Newman (2010) *Local Food Systems: Concepts, Impacts, and Issues*, ERR 97, US Department of Agriculture, Economic Research Service, May 2010.

Met Éireann (2020) The Irish Meteorological Service Online - Climate. <https://www.met.ie › climate>

MTU & FoodCloud (2022) Surplus Food Redistribution - An Opportunity to Reduce Farm Level Food Waste. Dept. of Agriculture Food and the Marine, Dublin, Ireland.

Mulrines (2018) Mulrines Irish Orchards. Available at: <https://www.mulrines.ie/mulrines-orchards/> (Accessed: January 3, 2023)

O'Connor, T., Kleemann, R. & J. Attard (2022) Vulnerable Vegetables and Efficient Fishers: A Study of Primary Production Food Losses and Waste in Ireland. *Journal of Environmental Management* 307:April:114498. <https://doi.org/10.1016/J.JENVMAN.2022.114498>.

O'Connor, L., Walton, J., & A. Flynn (2016). Fruit and vegetable intakes, sources and contribution to total diet in very young children (1–4 years): The Irish National Pre-School Nutrition Survey. *British Journal of Nutrition* 115:12:2196-2202. doi:10.1017/S0007114516001422

O'Mara, F.P. (2012) The role of grasslands in food security and climate change. *Annals of botany* 110:6:1263-1270.

OLIO (2022), The #1 Free Sharing App OLIO. Available at: <https://olioex.com/> (Accessed: December 21, 2022)

OzHarvest (2022) OzHarvest Market Waterloo. Available at: <https://www.ozharvest.org/ozharvest-market-waterloo/> (Accessed: December 29, 2022)

Re-Bon (2022) Réseau de glanage Nantais. Available at: <https://re-bon.wixsite.com/re-bon?fbclid=IwAR1Wnrhrz7FznjR3G30Mhehe7-DNNY26y2w02TEZguTyjUFx9NA7BVYSAM> (Accessed: December 29, 2022)

Revenue (2022) Charitable Donation Scheme. Available at: <https://www.revenue.ie/en/companies-and-charities/charities-and-sports-bodies/charitable-donation-scheme/index.aspx> (Accessed: December 28, 2022)

Rubies in the Rubble (2021) Condiments. But Gooder. Available at: <https://rubiesintherubble.com/> (Accessed: December 29, 2022)

SUNT (2022) About SUNT. Available at: <https://www.suntfood.com/en/about-us> (Accessed: December 29, 2022)

TasteAtlas (2023) Armagh Bramley Apples. Available at: <https://www.tasteatlas.com/armagh-bramley-apples> (Accessed: January 3, 2023)

Tsoupras, A., Moran, D., Pleskach, H., Durkin, M., Traas, C. & I. Zabetakis (2021) Beneficial Anti-Platelet and Anti-Inflammatory Properties of Irish Apple Juice and Cider Bioactives. *Foods* 10:412 <https://doi.org/10.3390/foods10020412>

USDA (2021) USDA Farmers to Families Food Box. Available at: <https://www.ams.usda.gov/selling-food-to-usda/farmers-to-families-food-box> (Accessed: December 29, 2022)

Vittuari, M., Azzurro, P., Gaiani, S., Gheoldus, M., Burgos, S., Aramyan, L., Valeeva, N., Rogers, D., Östergren, K., Timmermans, T. & H. Bos-Brouwers (2016) Recommendations and Guidelines for a Common European Food Waste Policy Framework. Bologna: FUSIONS EU.

Woolley, D., Martin, E. & E. Charlesworth (2015) Gleaning Network EU. <https://www.eu-fusions.org/phocadownload/feasibility-studies/Gleaning/Fusions%20Gleaning%20Network.pdf>

Appendix

Survey: Irish Apple Gleaning Project

Thank you for responding to the invitation to participate in the **Irish Apple Gleaning survey**. The survey should take no more than 15 minutes.

This survey is part of a study of utilising surplus apples, being carried out by FoodCloud in collaboration with the Circular Bioeconomy Research Group at Munster Technological University and funded by the Dept. of Agriculture, Food and the Marine. The Circular Bioeconomy Research Group are responsible for storage and analysis of any data collected in this survey.

The survey aims to collect information about the quantities of surplus edible apples that might be suitable for donation, the factors contributing to creating that surplus and current management strategies, and any challenges a farm may face when trying to donate surplus apples and supports that could help them do so.

Principal Investigator:

Dr. Jennifer Attard jennifer.attard@mtu.ie 085 764 6564

Postdoctoral Researcher:

Dr. Tracey O'Connor tracey.oconnor@mtu.ie 083 816 0650

This survey is anonymous, thus personal information will not be collected or stored as part of this survey, and neither you nor your farm will be identifiable. Any information that you provide will be stored in a secure, password-protected database up to five years after the end of the project (January 2023), after which point the data will be rendered anonymous, and aggregated with data about other farms, and original files will be deleted.

You don't have to take part in this study and you can opt out at any time prior to submitting the survey. To withdraw consent to participate in the survey prior to submitting the survey, just close the webpage without submitting the survey. Due to the anonymous nature of the study, if you submit a survey response, it will not be possible to withdraw your participation.

The data we collect in this study may be used in aggregate form in future studies. By agreeing to participate in this survey, you are also agreeing to the use, in aggregate form, of the data submitted in this survey, in a final report in future studies.

If you have queries/concerns about your involvement in this study, please contact the principal investigator, Dr. Jennifer Attard, email address: Jennifer.attard@mtu.ie, prior to beginning the survey.

Please indicate your consent to participate in this survey in the question below, after reading the information about the research study above and receiving answers to any questions that you may have about the study. For your records, you can make a copy of the information on this page, e.g. by saving this page as a .pdf, capturing it as a screenshot, or using the "snipping tool" on your computer.

As part of this project, FoodCloud are running a pilot study during which they will organise a group of volunteers to harvest apples from three apple farms. Harvesting will happen over 2 days per farm and growers will be paid €200 per tonne of surplus apples collected. To participate in the FoodCloud Apple Growers' pilot study, please contact Brian Curtin at FoodCloud, email: brian.curtin@foodcloud.ie; phone: 086 777 8842. Alternatively if you would prefer FoodCloud to contact you please access the following survey form to share your contact details with FoodCloud: <https://forms.gle/2grYFHt4pFPTJQFL9>

1. Do you agree to participate in this survey?*

Mark only one oval.

OYes *Skip to question 2 (section 3)*

ONo *Continue to section 2*

*Required

Section 2

Thank you for your time - you may now close the survey window

You have been directed to this page because you indicated that you do not consent to participating in the survey. You may exit the survey by closing the survey window in your browser.

If you have any questions about this survey, or the study, please contact the research team, using the contact information below.

Principal Investigator:

Dr. Jennifer Attard jennifer.attard@mtu.ie 085 764 6564

Postdoctoral Researcher:

Dr. Tracey O'Connor tracey.oconnor@mtu.ie 083 816 0650

FoodCloud Apple Gleaning Pilot Study

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FoodCloud: <https://forms.gle/2grYFHt4pFPTJQFL9>

Section 3

Farm Details

Thank you for agreeing to participate in this study.

The below questions are about your farm business and surplus apples which may arise on your farm.

All information you provide will be anonymous and cannot be traced back to you or your farm.

2.Location of farm (nearest town, county):

3.Approximately how many hectares do you grow apples on?

Mark only one oval.

☐ Less than 2 ha

☐ 2-4ha

☐ 5-9ha

☐ 10-19ha

☐ 20-29ha

☐ 30-39ha

☐ 40-49ha

- 0 50-59ha
- 0 60-69ha
- 0 70-79 ha
- 0 80-89ha
- 0 90-99ha
- 0 100 ha or more
- 0 Prefer not to say

4. Approximately how many tonnes of apples do you grow per year?

5. What proportion (%) of apples are grown for:*

Mark only one oval per row.

	None	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-7
Eating?	☐	☐	☐	☐	☐	☐	☐	☐
Cooking/culinary?	☐	☐	☐	☐	☐	☐	☐	☐
Juicing?	☐	☐	☐	☐	☐	☐	☐	☐
Cider?	☐	☐	☐	☐	☐	☐	☐	☐

◀
▶

6. During harvest and the month pre-harvest, what proportion (%) of grown apples would *

be:

Mark only one oval per row.

	None	Less than 1%	1-2%	3-5%	6-10%	11-15%	16-20%	21-25%
Lost (total)?	☐	☐	☐	☐	☐	☐	☐	☐
Lost due to pest damage (including birds)?	☐	☐	☐	☐	☐	☐	☐	☐
Lost due to disease damage (including rots)?	☐	☐	☐	☐	☐	☐	☐	☐
Dropped pre-harvest (including windfalls)?	☐	☐	☐	☐	☐	☐	☐	☐
Dropped accidentally during harvest operations?	☐	☐	☐	☐	☐	☐	☐	☐
Dropped deliberately during harvest operations (too small, too green etc.)?	☐	☐	☐	☐	☐	☐	☐	☐
Un-harvested (despite saleable quality)?	☐	☐	☐	☐	☐	☐	☐	☐

◀
▶

7. What are the reasons apples of saleable quality would not be harvested?

8. Post-harvest, what proportion (%) of harvested apples would be:*

Mark only one oval per row.

	None	Less than 1%	1-2%	3-5%	6-10%	11-15%	16-20%	21-25%
Lost (total)?	☐	☐	☐	☐	☐	☐	☐	☐
Lost due to disease during storage (including rot)?	☐	☐	☐	☐	☐	☐	☐	☐
Lost due to physiological damage during storage (e.g. bitter pit, scald)?	☐	☐	☐	☐	☐	☐	☐	☐
Lost due to general deterioration in storage (shriveled or fruit softening)?	☐	☐	☐	☐	☐	☐	☐	☐
Unsold (despite saleable quality)?	☐	☐	☐	☐	☐	☐	☐	☐

◀
▶

9. What are the reasons apples of saleable quality would be harvested but would not be sold?

10. What would you usually do with unsold apples (e.g. composted, animal feed, seconds for processing into juice or other products, etc.)?

11. What proportion (%) of the unsold apples would typically be managed in these ways?

12. Would any of these losses be edible without further processing, i.e. eaten raw, *

or as raw ingredients, for example for juicing (edible surplus)?

Mark only one oval.

☐ yes

☐ No *Skip to question 16*

Edible surplus apples

Edible surplus apples are those which are lost pre- or post harvest or unsold, but are edible.

13. Which months of the year would edible surplus apples typically occur on your farm?

14. What is the shelf-life of edible surplus apples arising on your farm?

15. What price would you typically be paid per tonne for edible surplus apples that are sold for animal feed, juicing, or any other alternative market?

Donation of edible surplus apples

Edible surplus apples are those which are lost pre- or post harvest or unsold, but are edible.

16. Are you donating any edible surplus apples to food redistribution* organisations, e.g. FoodCloud, or have you done so in the past, including through picking by volunteers (gleaning)?

Mark only one oval.

☐ Currently donating

☐ Donated in the past *Skip to question 20*

☐ Never donated *Skip to question 23*

Currently donating

17. What quantity and grade (retail, seconds, etc.) of apples are you donating to food redistribution organisations?

18. How are apples donated by your business (e.g. directly from farm storehouse or through picking by volunteers (gleaning))?

19. How often are apples donated by your business (e.g. weekly, monthly, annually)?

Skip to question 24

Past donations

20. What quantity and grade (retail, seconds, etc.) of apples were you donating when you donated food in the past?

21. How were apples donated by your business (e.g. directly from farm storehouse or through picking by volunteers (gleaning))?

22. How often was your business donating apples (e.g. weekly, monthly, annually)?

Skip to question 24

No previous donations

23. Would you consider donating any edible surplus apples to food redistribution organisations, either from the packhouse/self-harvested or through picking by volunteers?

Mark only one oval.

☐ Yes, from the packhouse/self-harvested

☐ Yes, through picking by volunteers

☐ No

Surplus apple redistribution: challenges and supports

24. Are there any challenges or drawbacks to donating edible surplus apples to food redistribution organisations, e.g. through gleaning or from packhouse? Please provide detail about the nature of those challenges/drawbacks, e.g. lack of information about how to donate, storage capacity, cost, absence of funding/return, logistics, time required to coordinate donation, etc. to help us understand the nature of the issues you face.

25. What would make it easier to donate edible surplus apples to food redistribution organisations, e.g. through gleaning or from the packhouse? Please provide detail about these solutions/supports, e.g. more information about how to donate, streamlined administrative

procedures, support for new technologies, additional labour, funding, etc. to help us develop relevant strategies.

26. If donating harvested apples, how much notice of donation availability would you be able to provide to the receiving organisation?

Mark only one oval.

- ☐ Less than 24 hrs
- ☐ 24-48 hrs
- ☐ 2-3 days
- ☐ 3-5 days
- ☐ 5-7 days
- ☐ More than a week
- ☐ More than a month

27. If volunteers were to pick surplus apples at the farm for donation, how much notice of apple availability would you be able to provide to the organisation coordinating volunteers?

Mark only one oval.

- ☐ Less than 24 hrs
- ☐ 24-48 hrs
- ☐ 2-3 days
- ☐ 3-5 days
- ☐ 5-7 days
- ☐ More than a week
- ☐ More than a month

Thank you for completing this survey!

Please submit your survey responses.

As part of this project, FoodCloud are running a pilot study during which they will organise a group of volunteers to harvest apples from three apple farms. Harvesting will happen over 2 days per farm and growers will be paid €200 per tonne of surplus apples collected.

To participate in the FoodCloud Apple Growers' pilot study, please contact Brian Curtin at FoodCloud, email: brian.curtin@foodcloud.ie; phone: 086 777 8842. Alternatively if you would prefer FoodCloud to contact you please access the following link to share your contact details with FoodCloud:

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Report 5 - Farm-Level Food Loss

Appendix 6 - Analysis of international approaches to agricultural recovery funding

Country	Approach	Key Initiatives	How it Works
France	Grant Funding, Producer Organisations, Mandatory Donation Legislation	'From Field to Plate' approach, Better Eating for All programme, French Federation of Food Banks	- The 'From Field to Plate' initiative emphasises sustainable, local, and quality food aid with strong links to local agricultural stakeholders. It supports solidarity agricultural production, gleaning, processing workshops, and rural transport. - Producer Organisations (POs) supply food banks through the EU market withdrawal mechanism, like Spain.
Spain	POs, Mandatory Donation Legislation, Tax Advantages	Spanish Federation of Food Banks (FESBAL), FEAGA (Spanish Agrarian Guarantee Fund), Food Losses and Waste Prevention legislation	- The Food Losses and Waste Prevention legislation (effective Jan 2025, with key obligations in effect from April 2026) includes an obligation for the producer or distribution sector to donate surplus food fit for consumption. - POs are a key element, enabling farmers to collaborate and strengthen bargaining power. POs can utilise EU-funded market withdrawals, where produce is donated to food banks and farmers are compensated by the EU (up to 5% of annual production, includes transport costs).
United Kingdom	Hybrid Funding (Grant and Private)	FareShare's Surplus with Purpose Fund	- Covers extra costs for businesses (growers, farmers, producers, retailers, etc.) to redistribute unsold or unfinished edible surplus food to FareShare's network of nearly 11,000 charities and community organisations. - Businesses offer food, explain remaining costs, FareShare indicates costs it can cover, and the business invoices FareShare for these costs. - Covers costs incurred from the point food is commercially rejected (e.g., harvest, grading, washing, packing, transport).

Report 5 - Farm-Level Food Loss

EU-wide	PO Proposal for inclusion in the CAP post 2027		PO market withdrawals as set out above. Further, the European Foodbank Federation (FEBA) proposes utilising CAP Pillar II's Agri-Environment-Climate commitments to co-finance surplus food recovery with Member States. This would incentivise farmers to harvest and donate edible surplus crops that are otherwise unmarketable, and support food banks in collecting these surpluses. Payments would be tied to recovered tonnage, mirroring existing national programs, and prioritising human consumption over animal feed or anaerobic digestion. The aim would be to create a sustainable, cost-effective system that ensures nutritious food reaches those in need, leveraging existing food bank networks.
USA	Tax incentives	Federal credits vouched for tax for produce	State agencies administering The Emergency Food Assistance Program (TEFAP) are federally funded to pay for projects to harvest, process, package, or transport commodities donated by agricultural producers, processors, or distributors for use by emergency feeding organizations (EFOs). These projects are known as 'Farm to Food Bank Projects.
Canada	Tax Incentives and Liability Protection	Federal and Provincial Tax Credits/Deductions, Provincial Liability Protection	• Federal law offers a charitable donation tax credit for individuals and a charitable deduction for corporations. • All Canadian provinces have enacted liability protection legislation for food donors. • Provincial incentives vary e.g., Ontario allows farmers to deduct 25% of fair market value for donations to eligible programs and Quebec provides farmers with a 50% tax credit on fair market value.
Australia	Tax Incentives	Proposed National Food Donation Tax Incentive	Legislation introduced in 2024 (although not yet passed) proposed a tax offset for food manufacturers and farmers who donate food to charity. This is designed to offset the cost of getting food to charities, as

Report 5 - Farm-Level Food Loss

			the cost of disposing of food can be far lower than donating it.
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Report 5 - Farm-Level Food Loss

Appendix 7 - Recommendations for an agricultural surplus redistribution programme

Jim Power (February 2025)

RECOMMENDATIONS FOR AN AGRICULTURAL SURPLUS REDISTRIBUTION PROGRAMME IN IRELAND

February 2025

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EXECUTIVE SUMMARY

OBJECTIVE OF REPORT

- The objective of this report is to make the case for policymakers to support the creation and funding of an agri-surplus redistribution programme in Ireland.
- The programme would redistribute surplus food to community partners across Ireland from growers that would otherwise not be able to donate due to the cost of doing so.
- The aim and benefits of such a programme would be to reduce farm level waste while at the same time providing fresh and nutritious produce to community partners. Those community partners are supporting vulnerable communities around the country during a difficult cost-of-living period when significant increases in fuel and food costs are putting those communities at risk of poverty.

THE PROBLEM – FOOD WASTE AND FOOD POVERTY

- Food waste and food poverty are significant global issues. A 2022 report from WWF and Tesco found that 2.5 billion tonnes of food go to waste each year, equating to about 40 per cent of all food grown. Eurostat estimates that in 2022, 59.2 million tonnes of food waste was generated across the EU, (132 kg/inhabitant), with an associated market value of €132 billion. Eurostat estimates that while this level of food waste is occurring, over 42 million people cannot afford a quality meal every second day (one with meat, chicken, fish or a vegetable equivalent).
- According to an EPA-funded research project on Food Loss and Waste from Farming, Fishing and Aquaculture in Ireland, within the food production stage 189,485 tonnes of food is lost or wasted before the farm gate or at harbours¹. Vegetable production accounts for the main source of food loss and waste at farm and fishery level, with approx.122,395 tonnes per annum. The main cause of food waste at the primary production stage is that: (1) products are not saleable as they are outside quality specifications; or (ii) lack of customer demand².
- There is increasing recognition of the connection between food waste and climate change and international and national targets have been set to reduce food waste by 50 per cent by 2030. UN Sustainable Development Goal (SDG) 12 seeks to 'ensure sustainable consumption and production patterns'. The third target under SDG 12.3 calls for cutting in half per capita global food waste at the retail and consumer level.

¹ https://www.epa.ie/publications/research/waste/Research_Report_410.pdf

² <https://www.epa.ie/our-services/monitoring--assessment/waste/national-waste-statistics/food/>

- While all this food waste is taking place, food poverty is a serious issue globally and in Ireland. 753 million people globally are food insecure and in 2021, 8.9 per cent of the Irish population experienced food poverty. 70 per cent of the community partners that FoodCloud works with have reported an increase in demand for their services, with 23 per cent unable to meet this demand³. These community partners are supporting vulnerable communities around the country during a difficult cost-of-living period when significant increases in fuel and food costs are putting those communities at risk of poverty.

BENEFITS OF SURPLUS FOOD REDISTRIBUTION FROM FARMS

- FoodCloud's Growers' Project is seeking to establish a national programme for the redistribution of surplus food from growers (that would not otherwise be able to donate due to cost) to community partners across Ireland. This type of project is well established in countries across the EU and internationally. This would result in reducing farm level food waste, whilst providing fresh and nutritious produce to community partners who are supporting those who need it most in communities across Ireland. In addition to the social benefits of reducing food waste, the environmental and economic benefits would also be very significant.
- Pilot programmes have been run by FoodCloud since 2022 testing different operational models; initially supplying its own network on a small scale, increasing in 2023 and 2024 to work with Local Development Companies (LDCs) or larger food banks to redistribute larger quantities of vegetables and to access rural communities that it was not previously able to access.
- Demand for food redistribution is very strong, reflecting food poverty since Covid-19 and the subsequent escalation in the cost of living. There is a strong demand for surplus food, particularly vegetables, and according to some community partners, the retail grocery stores, donating via FoodCloud, often do not have adequate supply of high-quality vegetables. Hence, it is important to source alternatives such as the primary producers. Some community partners suggest that faced with escalating costs, many consumers are opting for cheaper, lower quality food, so it is important they be given access to healthy food.
- Feedback from one community partner suggested that it is struggling to attract volunteers due to the lack of consistency in food supply for retail collections. Consequently, having access to the Growers' Project vegetables is important to ensure a consistent supply of fresh produce, and many community partners

³ FoodCloud Community Group Survey March 2024

suggest that they would struggle to survive without the surplus food that they receive through FoodCloud.

- The Growers' Project is having a positive impact for community groups from a nutritional, social, and money saving perspective, as they are now spending less to buy similar food. One of the challenges is to ensure that there is sufficient capacity to deal with food supplies. A consistent long-term funding model is essential.
- All available evidence supports the assertion that surplus food redistribution plays a very important role in communities around Ireland, and the experience with the Growers' Project has been very positive.

INTERNATIONAL EFFORTS TO RECOVER FARM LEVEL SURPLUS FOOD

This report considers examples of how food redistribution is addressed in selected countries. Significant efforts are being made at an international level to address food waste. On an EU level, the revised EU Waste Framework Directive adopted on 30th May 2018 requires Member States to reduce food waste at each stage of the food supply chain, monitor food waste levels and report back regarding progress made. It lays down obligations for Member States to prepare food waste prevention programmes (specific and/or as a part of general waste prevention programmes); to encourage food donation and other redistribution for human consumption; and to provide incentives for the application of the waste hierarchy, such as facilitation of food donation. A revision to the Waste Framework Directive is set to be published in 2025 to include binding targets for food waste reduction⁴.

Around the world, different operational and funding models are used to redistribute surplus food:

- FoodCloud operates in Ireland with virtual redistribution in supermarkets; that technology is also used in the UK, the Czech Republic, Slovakia and Kenya. FoodCloud also physically redistributes surplus food through its warehouses in Cork, Dublin and Galway. Through those warehouses and with its technology, FoodCloud has been piloting its Growers' Project with the support of private and grant funding.
- Tax incentives are used in the US and Canada and in Australia, legislation for tax incentives was being debated in November 2024.
- Grant funding is used in the UK, with both private and government grant funding.
- Producer Organisations are used in some EU countries which provide significant quantities of fresh produce to food banks, with Spain being a strong example.

⁴ Provisional targets have been agreed as at 19 February 2025 for a reduction of 10% in food processing and manufacturing and a reduction of 30% per capita in retail, restaurants, food services and households by 2030. The European Parliament and the Council will formally have to adopt the revised Directive before it can enter into force https://ec.europa.eu/commission/presscorner/detail/en/ip_25_548

- Mandatory food donation is used in France.

CREATING A FUNCTIONING FOOD REDISTRIBUTION MODEL IN IRELAND

The production of horticultural output in Ireland is a challenging business that is affected by: weather conditions; volatile output prices; high input costs in areas such as energy, labour, fertiliser, sprays and insecticides; margins are typically very tight; and there is considerable retailer concentration and power in the Irish retail grocery market.

Redistributing surplus food to people who require nutrition but cannot afford it is very important. However, currently, if farmers have surplus food production, they do not have the resources to make it available for food redistribution and instead either leave the crop in the ground and plough it back in or send it for animal feed or anaerobic digestion. From an environmental, social and economic perspective, these are not the optimal outcomes but farmers are already operating on low margins and with limited resources and therefore generally need support and incentives to distribute the surplus food to food redistribution organisations. Those incentives should cover basic costs of harvesting, packaging, transport, and the time commitment involved.

Given the significant problem of food waste globally and in Ireland and the benefits of redistributing surplus food (environmental, social, nutritional and economic), it is essential to have a system in place to scale up food donation and this requires aligned incentives that motivate individuals and companies to donate rather than discard surplus food.

There are 4 possible models of funding in an Irish context (these four options are discussed in more detail in Section 3 of this report):

- (1) Producer Organisations can leverage funding through the EU to support the redistribution of surplus produce to food banks.
- (2) The UK Surplus with Purpose hybrid funding model (government and private funding).
- (3) Tax incentives.
- (4) Direct funding from the Government.

As Producer Organisations are not widespread in horticulture in Ireland, they are unlikely to work as a funding model for the redistribution of surplus agricultural produce.

The hybrid model used in the UK would not result in certainty and consistency and would represent a suboptimal solution.

In the short-term the most appropriate approach for Ireland is direct funding from Government. To achieve maximum results and address the many issues associated with food waste, a multi-year funding programme should be created to generate certainty and continuity.

In the longer-term, policymakers should move towards a model of tax incentives. Such a model should cover the costs of production and distribution for the primary producer. However, tax incentives could also be used to encourage philanthropic donations to food redistribution NGOs and charities. International examples of tax incentives for surplus food redistribution can be used as a basis for structuring a tax incentive model that would work in the Irish context.

As detailed in Table 1 below, the Grower’s Project at scale over 5 years is estimated to cost €3 million annually, which would cover a contribution towards the growers’ costs of donation, a contribution towards FoodCloud’s redistribution costs (physical and virtual redistribution) and the cost of third party logistics. This investment would result in:

- Annual rescue and redistribution of 5,000 tonnes of fresh fruit and vegetables.
- Saving 9,000 tonnes of carbon emissions from going to waste.
- Provision of the equivalent of 11.9 million meals.

As demonstrated by the benefits of food redistribution from farms cited above, the real return to the State would be very significant.

In the longer-term, it is recommended that policymakers move towards a model of tax incentives. Such a model should cover the costs of the primary producer (harvesting, packaging, transport, time/resource required). The quantum of the incentive, the size of the company eligible to receive it, and the need to avoid market distortion will all need to be taken into account as to how this would work in Ireland and further work is required in this regard.

There may also be an opportunity for farm-level surplus redistribution to be funded through the EU’s Common Agricultural Policy (CAP), LEADER funding or the ERDF. The European Food Bank Network (FEBA) is currently reviewing this possibility. For the next EU funding cycle (2028-2034), FEBA proposes utilising CAP Pillar II’s Agri-Environment-Climate commitments to co-finance surplus food recovery with Member States. This would incentivise farmers to harvest and donate edible surplus crops that are otherwise unmarketable, and support food banks in collecting these surpluses. Payments would be tied to recovered tonnage, mirroring existing national programs, and prioritise human consumption over animal feed or anaerobic digestion. The aim would be to create a sustainable, cost-effective system that ensures nutritious food reaches those in need, leveraging existing food bank networks.

Table 1: FoodCloud Grower’s Project 5-Year Projections

Environmental and social impacts	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnes of surplus to be redistributed	500	2000	3000	4000	5000

Approx. tonnes carbon emissions avoided	900	3600	5400	7200	9000
Approx. number of meals provided	1.2m	4.7m	7.1m	9.5m	11.9m

Source: FoodCloud

ABOUT FOODCLOUD

FoodCloud is a non-profit social enterprise established in 2013 working to tackle the twin issues of food waste and food security. FoodCloud partners with leading retailers and food companies to redistribute surplus food to community and voluntary organisations (community partners) working to support those who need it most.

FoodCloud has developed two solutions:

(1) A pioneering technology platform (Foodiverse) that redistributes surplus food from the retailers directly to community partners across Ireland. FoodCloud also shares this technology platform, developed in Ireland, with food redistribution NGOs in the UK, the Czech Republic, Slovakia and Kenya.

(2) Through three warehouses (FoodCloud Hubs) in Dublin, Cork, and Galway, FoodCloud redistributes large quantities of surplus food from across the food supply chain to a network of over 685 community partners all over Ireland. In addition, FoodCloud has engaged in gleaning projects where volunteers collect leftover crops from farmers' fields after they have been commercially harvested or on fields where it is not economically profitable to harvest. In collaboration with Meade Farm, volunteers have collected a range of high-quality crops (by hand) such as potatoes, onions, carrots and broccoli.

FoodCloud also delivers an EU funded food aid programme (ESF+ Food Support), on behalf of the Department of Social Protection, where it is responsible for the procurement, storage and distribution of €4-5 million worth of food aid annually to over 160 community partners in Ireland.

In 2024, FoodCloud redistributed 33,244 tonnes of surplus food across 6 countries. This is the equivalent of 79 million meals of surplus food being redistributed and resulted in 76,400 tonnes of CO₂-equivalent being avoided. In Ireland, FoodCloud redistributed 3,896 tonnes of surplus food; the equivalent of 9.28 million meals of surplus food and resulted in 12,467 tonnes of CO₂-equivalent being avoided.⁵

Since 2013, FoodCloud has redistributed 338.9 million meals equivalent to a network of approximately 6,000 community partners across 6 countries worldwide. This resulted in the saving of over 142,318 tonnes of food going to waste and an estimated 425,515 tonnes of CO₂-equivalent has been avoided.

⁵ FoodCloud 2024 Impact

FoodCloud's **mission** is to transform surplus food into opportunities to make the world a kinder place. Its **vision** is a world where no good food goes to waste.

FOODCLOUD'S GROWER'S PROJECT

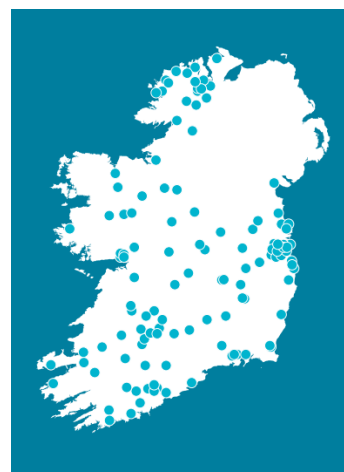
FoodCloud's Grower's Project is seeking to establish a national programme for the redistribution of surplus food from growers, who would not otherwise be able to donate due to cost, to community groups across the country. This would result in reducing farm level food waste whilst providing fresh and nutritious produce to community groups who are supporting those who need it most.

FoodCloud has received funding for the Grower's Project through the Department of Agriculture, Food and the Marine's (DAFM) Rural Innovation and Development Fund funding stream in 2022, 2023 and 2024 and also from private funders. FoodCloud is planning to further scale the project in 2025. The project has potential for significant scale but has been limited by the annual budget of the funding available (€60,000 in 2022, €178,301 in 2023 and €165,000 in 2024), and also by the stop-start nature of the project due to the annual funding cycle.

FoodCloud has piloted different operational models; initially supplying its own network on a small scale and then increasing in 2023 and 2024 to work with Local Development Companies (LDCs) or larger food banks to redistribute larger quantities of vegetables and to access rural communities that it was not previously able to access (Donegal, Kerry and northwest Cork). FoodCloud has also trialled the use of its technology (Foodiverse) for direct donations between growers and community groups (Foodiverse was previously used only by retailers).

With this funding, FoodCloud has achieved the following key results:

- Distribution of 356.9tn of produce that would otherwise have been sent to anaerobic digestion or for animal feed (pilot: 30tn; 2023: 91.5tn; 2024: 235.4tn).
- Participation of 9 different growers (pilot: 5; 2023: 5; 2024: 8).
- Avoidance of greenhouse gas emissions of approx 815tn CO₂-eq (pilot: 98tn CO₂-eq; 2023: 293tn CO₂-eq; 2024: 424tn CO₂-eq).
- The participating growers have recovered €165,290 in costs by redistributing this produce rather than sending it to animal feed or anaerobic digestion (pilot: €13,621; 2023: €54,986; 2024: €96,683).
- Distribution of fresh vegetables to 237 different community organisations across Ireland - the accompanying map demonstrates the geographical spread.
- The produce received by the 237 community groups was the equivalent of 850,991 meals (pilot: 72,969 meals 2023: 217,770 meals; 2024: 560,252 meals) and the produce had an estimated retail value of €601,523 (pilot: €29,900; 2023: €175,852; 2024: €395,771).



Demand has increased significantly from FoodCloud’s community partners and FoodCloud is now supplied with surplus vegetables by 8 growers. Feedback from the recipient community groups has been overwhelmingly positive and there is also greater demand from groups that FoodCloud does not currently supply with this produce: 99 per cent of the 93 groups surveyed in November 2024 confirmed they would use the Growers’ Project vegetables if they were available in their area.

Comments included: *“At Bud’s FRC, we are committed to promoting healthy eating habits within our community. We believe that access to fresh, unprocessed foods is crucial for overall well-being, and this initiative aligns perfectly with our ongoing efforts. Partnering with FoodCloud and the Grower’s Project would provide an invaluable opportunity to further educate our members on the benefits of consuming whole, unprocessed foods and to directly improve their access to nutritious options. We are confident that this collaboration would yield significant positive results for our community’s health and well-being, and we would be honoured to participate.”*

A summary of the project’s impact is outlined in Table 2.

Table 2: Summary of Impact of FoodCloud Growers’ Project

	Vegetables distributed from farms (tn)	Participant growers	Recipient community partners	Meals equivalent	Greenhouse Gas savings (tn)	Costs recovered by growers	Retail value
2021-22	30	5	116	72,969	98	€13,621	€29,900
2023-4	91.5	5	182	217,770	293	€54,986	€175,852
2024-5	235.4	8	207	560,252	424	€96,683	€395,771
Total	356.9	9 different growers	237 different community groups	850,991	815tn	€165,290	€601,523

Source: FoodCloud

SCOPE OF REPORT

This policy briefing paper is intended for submission to the Irish government and policymakers to support the creation and funding of an agri-surplus redistribution programme in Ireland. The programme would redistribute surplus food from growers that they would otherwise not be able to donate due to cost, to community partners across Ireland. The aim and benefits of such a programme would be to reduce farm level waste while at the same time providing fresh and nutritious produce to community partners who are supporting those who need it most in communities across Ireland.

The preparation of the report involved a multi-faceted approach. It involved:

- Desk-based research examining Irish, EU, and international best practice.
- Desk-based research analysing global data on food waste.
- Interviews with an Advisory Panel created to assist with the policy briefing paper, including those involved in academic research in this area, food production; community partners; retail; transportation and logistics; the Department of Agriculture, Food and the Marine; the EPA; and Teagasc. The author sought to reflect the various views in the preparation of the briefing paper in a non-attributable manner.
- Interviews with international food redistribution NGOs.
- Constant engagement with FoodCloud personnel to garner an understanding of the potential scale and costs of a food redistribution programme.

SECTION 1: THE PROBLEM – FOOD WASTE AND FOOD POVERTY

In any consideration of possible policy recommendations to address food waste and redistribution, it is important to identify the problem. There are two significant issues – the significant level of food waste and food loss that occurs at a global level, and the widespread global prevalence of food poverty. The challenge is to alleviate these problems.

The European Commission defines food waste as any food that becomes waste under the following conditions:

- It has entered the food supply chain (i.e. post harvesting).
- It has then been removed or discarded from the food supply chain, or at final consumption stage, and
- It is finally destined to be processed as waste.

Food surplus at the farm level is food that has been produced on the farm, but which cannot be distributed to retailers due to factors such as:

- lacking adequate specification;
- it can be harvested and packed, and although it fails to meet retail specifications, it is still suitable to eat;
- a crop that may be within specification, but which is not financially viable to harvest;
- reduction or cancellation of orders from retailers;
- over-production due to factors such as weather or sub-optimal crop planning.

Food surplus on the farm is typically ploughed back into the soil; is sent for anaerobic digestion; or is used for animal feed. The reality is that the production of the food has involved significant labour and other input costs, and it has resulted in significant greenhouse gas (GHG) emissions and unnecessary land use impacts. By redistributing this food to people rather than for other uses, economic value is saved, and nutritious food is distributed to those in need.

QUANTIFICATION OF FOOD WASTE IN THE EU

Eurostat estimates that in the EU in 2022, 59.2 million tonnes of food waste (132 kg per inhabitant) was generated, with an associated market value estimated at over €132 billion. Appendix 1 provides a breakdown of food waste by sector in the EU in aggregate terms and Kg per person. Appendix 2 outlines food waste by sector of activity by EU member country in tonnes. Appendix 3 outlines food waste by sector of activity per EU member country based on Kg per inhabitant.

QUANTIFICATION OF FOOD WASTE IN IRELAND

Food loss and waste is also a significant issue in Ireland. The EPA estimates that Ireland generated 750,000 tonnes of food waste in 2022. This equates to 146 kg of food waste per person and is higher than the EU average of 132 kg. (Appendix 4 provides a breakdown of food waste by supply chain sector in Ireland).

The EPA estimates that in 2022, 53,000 tonnes of food waste (7.1 per cent of the total) was generated at the primary production stage in Ireland. Of this, horticulture accounted for the largest share. The main cause of food waste at the primary production stage is that products are not saleable as outside quality specifications or lack of customer demand.⁶

As required under the Waste Framework Directive, EPA reports on waste and is based on data from an EPA-funded research project by O'Connor & Attard (2022) which estimates that in 2020, within the food production stage, 189,483 tonnes of food was lost or wasted before the farm gate or at harbours. Vegetable production accounted for the main source of food loss and waste at farm and fishery level, with approximately 122,395 tonnes per annum.⁷

The data from O'Connor & Attard includes on the farm and post-harvest loss as well as waste⁸. Table 3 shows a breakdown by food sector of food waste and food loss.

Table 3: Food Loss and Waste (tonnes/annum) by Food Sector, 2020

FOOD SECTOR	LOSS & WASTE (TONNES)	%
Meat	41,726	22.0%
Milk, Eggs & Honey	4,185	2.2%
Potatoes	72,838	38.4%
Other Vegetables	49,557	26.2%
Fruit	3,803	2.0%
Grains & Legumes	12,502	6.6%
Fishing	174	0.1%
Aquaculture	4,698	2.5%
Total	189,483	100.0%

Source: https://www.epa.ie/publications/research/waste/Research_Report_410.pdf

⁶ <https://www.epa.ie/our-services/monitoring--assessment/waste/national-waste-statistics/food/>

⁷ https://www.epa.ie/publications/research/waste/Research_Report_410.pdf

⁸ As summarised in the report referenced at note 8 by reference to "European Commission, 2020. Guidance on Reporting of Data on Food Waste and Food Waste Prevention", "Food loss, which does not need to be reported to the EC, is described as "the loss of potential food prior to the harvest of crops or animal products" while food waste is "the loss of harvested food, before it can pass into the next stage of the supply chain".

FOOD POVERTY IN IRELAND

In Ireland, while this food waste is occurring, 75 per cent of the community partners that FoodCloud works with have reported an increase in demand for their services with 24 per cent unable to meet that demand. These community partners are supporting vulnerable communities around the country during a period that has seen a significant increase in the cost-of-living.

Although the headline rate of inflation has fallen sharply from 9.2 per cent in October 2022 to 1 per cent in November 2024, the average cost of living in November 2024 is 20.4 per cent higher than in November 2020. Average food prices are 21.6 per cent higher; rents are 34 per cent higher; and electricity is 54.9 per cent higher.

The escalation in the cost of necessities is putting many households at risk of poverty. The Irish Times (12th December 2024) reported that the Capuchin Day Centre in Dublin never before ran out of tickets for pre-Christmas food vouchers so quickly after the launch of the annual project in the face of unprecedented demand. This is a clear indication of the pressures facing many families and communities now.

There is no official food poverty indicator in Ireland. In 2012, the Economic and Social Research Institute (ESRI) developed a measure which defined food poverty as the inability to have an adequate and nutritious diet due to issues of affordability or accessibility. This measure is derived using data collected as part of the annual Survey on Income and Living Conditions (SILC).

Using this approach, food poverty is measured by the percentage of individuals experiencing one or more of the following:

- Unable to afford a meal with meat, or vegetarian equivalent, every second day. This indicator suggests severe food deprivation and is 1 of the 11 deprivation items used for the consistent poverty measure.
- Unable to afford a weekly roast dinner (or vegetarian equivalent). This indicator refers to the affordability of food, and in addition, the affordability of a cultural norm. While reference to a weekly roast may seem outdated, the indicator refers to those who cannot afford this. This item is also 1 of the 11 deprivation items used for the consistent poverty measure.
- Missing one substantial meal in the last fortnight due to lack of money. This item, in its reference to the affordability of food, but not the quality or adequacy of it, refers to severe food deprivation. The most recent figures, based on this measure, are set out below; Table 4 shows that in 2021, 8.9 per cent of the Irish population experienced food poverty.

Table 4: Percentage of the Population Experiencing Food Poverty⁹

Food Poverty Rate	2014	2015	2016	2017	2018	2019	2020	2021
(%)	13.1	12.2	9.8	8.7	7.0	7.4	12.0	8.9

Related research from Barnardos¹⁰ shows the following:

- 25 per cent of parents often worry about not being able to provide food for their children.
- 3 in 10 people have witnessed food poverty first-hand in Ireland.
- 51 per cent of parents have in the past cut back spending in areas such as gas and electricity, transport and medical bills to afford food.
- 10 per cent of those looking after children skip meals in an average week.
- 9 per cent of parents feel 'close' to food poverty.

In terms of nutrition, the Healthy Ireland initiative from the Department of Health recommends that people eat five to seven portions of fruit, vegetables, and salad daily.

The redistribution of surplus food from farms to lower income people is totally consistent with the health aspirations of Irish health policy. The food pyramid is used to make healthy eating easier. It shows the different food groups and how much of each we need to have a healthy diet. Eating the right amount from each food group is called eating a 'balanced diet.' The food redistributed from farms, such as vegetables, salads and fruit, are included in the first shelf of the food pyramid.

A recent Department of Social Protection and Amárach Research report, titled '*The Prevalence of Food Poverty in Ireland*',¹¹ has highlighted the particular challenges that individuals in rural areas have in accessing discount stores/food and the challenges that food services in these same areas have in accessing regular supplies of discounted or donated food to deliver as food support in their communities. The subsequent '*Action Plan on Food Poverty*' prioritises supporting food poverty measures through SICAP and Local Development Companies (LDCs).

The problem of food poverty in Ireland is very real and from a social and moral perspective, it is incumbent on Irish society and its policymakers to do whatever it takes to alleviate the crisis.

⁹ Source:

<https://www.gov.ie/en/press-release/919b8-minister-obrien-welcomes-publication-of-the-report-on-food-poverty-government-programmes-schemes-and-supports/>

¹⁰ <https://www.barnardos.ie/news/2022/february/child-food-poverty>

¹¹ 'The Prevalence of Food poverty in Ireland', Research report prepared for the Department of Social Protection by Amárach, 11th December 2023.

SECTION 2: BENEFITS OF SURPLUS FOOD REDISTRIBUTION FROM FARMS

The problem is clear. Food waste is a global phenomenon that has environmental, social and economic consequences. More than one third of the food produced globally is wasted. This is a significant contributor to climate change as food loss and food waste contribute 8-10 per cent of global GHG emissions. Food redistribution is one of the most effective ways of addressing food surplus once it occurs and preventing it from becoming food waste.

In the food waste hierarchy, the prevention of food waste at source should be the primary objective. The next best option is to redistribute food to feed people. (Table 5).

From an environmental, social & nutritional, and an economic perspective, the benefits of surplus redistribution from farms are significant.

Redistribution of surplus food is an important way of avoiding food becoming waste and to support charities who help people living in food poverty. In 2024, FoodCloud redistributed 3,896 tonnes of food in Ireland donated by 185 Irish food producers, distributors, and retailers. It supported 685 community groups.

Table 5: Food Use and Waste Hierarchy

Prevention at source	● Avoid surplus food generation in the whole food value chain.
Donate or redistribution of surplus food	● Donating surplus food for human consumption, or distributing it through food banks or other redistribution organisations.
Use for animal feed	● Using food no longer intended for human consumption as animal feed.
Industrial use	● Transforming food-based materials (non-waste) into added-value products for food and non-food purposes (e.g. pharmaceuticals, cosmetics).
Recycling and nutrient recovery	● Transforming food waste into low added-value products such as compost and biogas (with use of nutrients), construction materials, adhesives etc.
Energy recovery	● Biogas (without use of nutrients) or biofuel production from food waste ● Food waste incineration with energy recovery.
Disposal	● Food waste incineration without energy recovery. ● Sending food waste to landfill.

ENVIRONMENTAL BENEFITS OF SURPLUS REDISTRIBUTION FROM FARMS

Growing, processing, and transporting food all use significant amounts of resources such as land, water, and energy. From an environmental perspective, the production of food that is subsequently wasted has a very negative impact on GHG emissions, water usage, eutrophication, acidification of soil, increased land use, and damage to biodiversity.

Food waste measurement has a key role to play in the strategies for food waste reduction. Reducing food waste would:

- Help farmers, companies and consumers to save money.
- Decrease the environmental impact of food production, transport, processing and consumption.

Given its important environmental and economic impacts, food waste prevention and the need to adopt a more sustainable production and consumption model is a priority in the EU's Circular Economy Action Plan. The Action Plan called on the European Commission to establish a multi-stakeholder platform dedicated to food waste prevention.

A 2022 report¹³ from WWF and Tesco found that 2.5 billion tonnes of food goes uneaten around the world each year and is wasted, equating to about 40 per cent of all food produced. This estimate is based on the 1.2 billion tonnes of food loss on farms calculated within the research; 931 million tonnes wasted in retail, food service and consumer homes; and 436 million tonnes occurring in the post farmgate transport, storage, manufacturing and processing stages. The report suggests that 2.5 billion tonnes is an indicative estimate of whole supply chain losses, but it recognises that the methods used, and the assumptions made to reach this figure mean it is likely to be an underestimation.

The consequences of this level of food loss are very significant. The WWF research suggests that 4.4 million square kilometres of land is used to grow food which is lost on farms each year; 2.2 gigatonnes CO₂ equivalent is the overall carbon footprint of farm stage waste, approximating 4 per cent of all anthropogenic GHG emissions and 16 per cent of agricultural emissions, which is equivalent to the emissions from 75 per cent of all cars driven in the US and Europe annually; and food waste in total accounts for 1 per cent of total GHG emissions.

¹²<https://publications.jrc.ec.europa.eu/repository/handle/JRC137760>

¹³https://www.panda.org/discover/our_focus/food_practice/food_loss_and_waste/driven_to_waste_global_food_loss_on_farms#:~:text=Driven%20to%20Waste%3A%20Global%20Food,billion%20tonnes%20wasted%20each%20year.

In its global agricultural outlook (July 2024), the OECD-FAO¹⁴ undertook a stylised scenario measuring the impact of halving food losses along supply chains and food waste at the retail and consumer levels by 2030. The modelled scenario projects a potential 4 per cent reduction in global agricultural GHG emissions by 2030. These reductions are distributed relatively evenly across countries, regardless of income levels. The modelling exercise also suggests that food prices would fall, resulting in a 10 per cent increase in food intake in low-income countries, and 6 per cent in lower-middle income countries. This would have the effect of reducing the number of undernourished people by 153 million by 2030, which would be equivalent to a reduction of 26 per cent.

There is increasing recognition of the connection between food waste and climate change. Reducing food waste is increasingly seen as an important climate action. Ireland has committed to achieving a 50 per cent reduction in food waste by 2030 under UN SDG 12.3.

The Food Waste Charter is a voluntary agreement led by the EPA and supported by state agencies such as Teagasc, Bord Bia, Bord Iascaigh Mhara, Enterprise Ireland, and Fáilte Ireland to promote a collective food and drink sector commitment to reduce food waste along the entire food supply chain.

There are challenges involved in measuring precisely the impact of surplus food redistribution due to the lack of a standard CO₂ taxonomy for food categories, and the variation in CO₂ equivalent according to product origin. Based on 2022 levels of food waste as measured by the EPA, a 50 per cent reduction in food waste by 2030 could result in a reduction of up to 503,000 tonnes of CO₂ equivalent. The study by Attard and O'Connor estimated that primary food production accounted for 189,485 tonnes of food loss and waste. A 50 per cent reduction in primary food waste based on this figure could result in a reduction of 127,000 tonnes of CO₂ equivalent.

NUTRITIONAL & SOCIAL BENEFITS OF SURPLUS REDISTRIBUTION FROM FARMS

The importance of good nutrition for health is clear; the US CDC¹⁵ lists many benefits of healthy eating.

- May help you live longer.
- Keeps skin, teeth, and eyes healthy.
- Supports muscles.
- Boosts immunity.
- Strengthens bones.
- Lowers risk of heart disease, type 2 diabetes, and some cancers.
- Supports healthy pregnancies and breastfeeding.
- Helps the digestive system function.

¹⁴ OECD-FAO Agricultural Outlook 2024-2033, July 2024

¹⁵ <https://www.cdc.gov/nutrition/php/resources/healthy-eating-benefits-for-adults.html>

Reducing food loss and waste can make a significant contribution to providing a healthy and nutritious diet to a growing global population. Ensuring more of the global food supply is used to feed people, rather than being left in the field or being disposed of, is an important strategy for addressing hunger in a world where there is considerable malnutrition.

The social benefits are very important as good nutrition and a balanced diet improve quality of help, quality of life, and results in a happier and more fulfilled individual. The FoodCloud research report 'More Than Food - Surplus Food Redistribution During the Covid-19 Pandemic' also highlights the impact of surplus food for those individuals that receive it: *'It helped to relieve financial pressure on their food budgets, provided social connection with interaction around food and added to their overall sense of well-being.'*¹⁶

The research showed that relieving financial pressure on the food budgets allowed individuals to pay for their children's school activities and fuel to gain independence when living in rural areas so they did not have to rely on others for transport.

The food provides a social connection as it provides a gateway for other areas of support; such as assistance with completing forms, advice on different areas or just to listen to someone. Community groups that serve meals such as day care centres or meals on wheels services also provide an environment in which people can interact with others when they might not otherwise get the opportunity to do so.

There are also benefits in linking local farmers and their local community groups for both parties; the farmer knows that his produce is finding a good home and the community groups can benefit from the fresh local produce.

ECONOMIC BENEFITS

The social benefits from surplus food redistribution are clear, but there are also significant economic benefits to surplus redistribution:

- To grow food, requires significant input costs such as land usage, machinery costs; labour costs; cost of capital; and fertilisers. The costs are incurred from the preparation of the land to the harvesting of the produce. If the food is wasted, all of these costs are incurred for no good reason.
- Food production would become more sustainable and provide employment and benefit rural economic activity.
- By redistributing surplus food, food businesses can eliminate costs spent on storage and warehouse capacity and the costs involved in dealing with food waste.
- The community groups and individuals that receive the products save money on food bills and are able to use that money towards other essentials.

¹⁶ Share, M., Share, P. & Delaney, C. (2022). More than Food: Surplus Food Distribution during the Covid-19 pandemic:Report. Dublin: FoodCloud <https://doi.org/10.25546/100144>

- If growers receive a contribution towards the costs for their donations, it assists with their financial viability.
- By consuming more nutritious food, the health outcomes are positive and will ultimately save money on the provision of healthcare.
- Redistributing surplus food is good for the environment as it reduces carbon emissions and could ultimately save fines associated with carbon emissions in the context of global environmental commitments.
- Having strong ESG credentials is now an essential ingredient for business success and sustainability. Food redistribution can help businesses build their ESG credentials, which is now essential for businesses in the context of raising capital and satisfying investor expectations.

CONCLUSIONS

All available evidence supports the assertion that surplus food redistribution plays a very important role in communities around Ireland, and the experience with the Growers' Project has been very positive. Demand for food redistribution is very strong, reflecting food poverty since Covid-19 and the subsequent escalation in the cost of living. There is a strong demand for surplus food, particularly vegetables, and stores often do not have adequate supply of high-quality vegetables. Faced with escalating costs, many consumers are opting for lower quality cheap food, so it is really important they be given access to healthy food.

Some of the networks are struggling to attract volunteers due to the lack of consistency in food supply. Consequently, having access to the Growers' Project is important to ensure a consistent supply of food, and many networks would struggle to survive without the surplus food distributed by FoodCloud.

The Growers' Project is having a positive impact for community groups from a nutrition, social, and money saving perspective, as they are now spending less to buy similar food. One of the challenges is to ensure that there is sufficient capacity to deal with food supplies. A consistent long-term funding model is essential.

SECTION 3: INTERNATIONAL & IRISH APPROACH TO FOOD WASTE & SURPLUS FOOD REDISTRIBUTION: CASE STUDIES

Significant efforts are being made internationally to address food waste.

The Global Food Donation Policy Atlas is an initiative to promote better laws on food donation to help address food loss and food insecurity. The policy issues associated with food donation are outlined in The Global Food Donation Policy Atlas.¹⁷

(1) Date Labelling

Confusing date labels on food products are a major driver of food waste and act as an obstacle to food donation. Laws should differentiate between quality and safety-based labels to reduce unnecessary waste.

(2) Food Safety for Donations

Clear, accessible guidance on food safety that is specific to donated food is necessary to encourage donation and protect public health.

(3) Food Waste Deterrence

Governments should establish food donation requirements or food waste deterrence laws that require that food is recovered and donated instead of going to waste.

(4) Government Grants and Incentives

National and local grants and incentives can drive the scaling of food donation, especially in countries where tax benefits are insufficient, or where limited infrastructure hinders food recovery.

(5) Liability Protection for Donations

An absence of clear and comprehensive legal protection for donors can result in food donors discarding safe surplus food instead of donating it to food recovery organisations.

(6) National Law or Policy on Food Waste

Adopting a national food loss and waste, or food donation framework can help governments advance food recovery efforts along the food supply chain.

¹⁷ <https://atlas.foodbanking.org/map/>

(7) Tax Incentives and Barriers

For food donors, fiscal barriers, such as high transportation and storage costs can act as a barrier to food recovery organisations. Tax regimes can play a crucial role in discouraging or incentivising donation.

(8) Emissions, Environmental, and Food Waste Reporting Policies

Companies need to know how much food waste exists and where it occurs in their supply chain before they can implement an effective solution. Companies should be required to measure and report their emissions. Given that food waste is such a significant emitter of GHG in the absence of broader emissions reporting, standardised food loss and waste reporting could be an effective first step for governments hoping to ensure that food entities quantify their food waste and identify points where reduction is possible.

EU APPROACH

The EU is committed to meeting the SDG Target 12.3 to halve per capita global food waste at the retail and consumer level by 2030 and to reduce food losses along the food production and supply chains.

The EU Platform on Food Losses and Food Waste was established in 2016. It has supported the Commission in its work to adopt EU guidelines to facilitate food donations and the use of food no longer intended for human consumption as animal feed. It has also developed a food waste measurement methodology and undertaken work to improve date marking practices.

The European Commission has agreed a general approach to introducing amendments to the Waste Framework Directive. These amendments propose the introduction of mandatory food waste reduction targets. These include a 10 per cent reduction in food waste from processing & manufacturing and a 30 per cent reduction from retail, restaurants, food services and households.

To ensure that national efforts against food waste are informed by a solid evidence base, and support sharing of innovation and best practice, the EU has been working on augmenting and improving the quantification of food waste levels.

The revised Waste Framework Directive adopted on 30th May 2018 requires Member States to reduce food waste at each stage of the food supply chain, monitor food waste levels and report back regarding progress made. Moreover, it lays down obligations for Member States to:

- Prepare food waste prevention programmes (specific and/or as a part of general waste prevention programmes).

- Encourage food donation and other redistribution for human consumption, prioritising human use over animal feed and the reprocessing into non-food products as part of measures taken to prevent waste generation.
- Provide incentives for the application of the waste hierarchy, such as facilitation of food donation (articles 4 and 9 of the revised Waste Framework Directive).

A revision to the Waste Framework Directive is set to be published in 2025 to include binding targets for food waste reduction¹⁸.

IRISH GOVERNMENT POLICY TOWARDS FOOD WASTE

The Irish Government has stated its commitment to reducing food waste by 50 per cent by 2030, in line with the United Nations Sustainable Development Goals (SDG 12.3). The development of a National Food Waste Prevention Roadmap is included as a commitment in Ireland's Waste Action Plan for a Circular Economy, Food Vision 2030, and the Government's Climate Action Plan 2021.

The approach and policy position of the Irish Government to food waste is set out in detail in 'Ireland's National Food Waste Prevention Roadmap 2023-2025'.¹⁹

- The Irish government accepts that tackling food loss and food waste is one of the key steps it can take to achieve sustainability, help combat climate change and support Ireland's transition to a circular economy and bioeconomy.
- It accepts that reducing food waste brings savings for consumers and operators, and the recovery and redistribution of surplus food that would otherwise be wasted also has an important social dimension in terms of providing safe food for those in need.
- It accepts that redistribution of surplus food can help to address food poverty. Tackling food waste also ties in with policies on the recovery of nutrients and secondary raw materials, the production of feed, food safety, biodiversity, bioeconomy, waste management and renewable energy.
- Food waste can occur at any point along the food supply chain, from primary production (e.g., damage to harvested crops), processing and manufacturing (e.g., waste arising from quality control processes), retail and distribution (e.g., unsold stock), restaurants and food services (e.g., food uneaten by customers) and households (e.g., purchased food not consumed on time).

¹⁸ Provisional targets have been agreed as at 19 February 2025 for a reduction of 10% in food processing and manufacturing and a reduction of 30% per capita in retail, restaurants, food services and households by 2030. The European Parliament and the Council will formally have to adopt the revised Directive before it can enter into force https://ec.europa.eu/commission/presscorner/detail/en/ip_25_548

¹⁹ <https://www.gov.ie/en/publication/824c3-national-food-waste-prevention-roadmap-2023-2025/>

The official position is that food waste generation can arise due to different factors in each sector and different solutions may be needed depending on the sector.

SURPLUS FOOD REDISTRIBUTION CASE STUDIES

Around the world, many different options are used to redistribute farm level surplus food. A cross-section selection of case study approaches is outlined here, but across the world many different varieties of approach are used.

HYBRID FUNDING (GRANT AND PRIVATE) - IRELAND

FoodCloud operates in Ireland with virtual redistribution in supermarkets and physical redistribution through its warehouses in Cork, Dublin and Galway. FoodCloud has been piloting its agricultural surplus recovery programme (the Growers' Project) through its warehouses with the support of private and grant funding.

The aim of the Growers' Project is to facilitate the redistribution of surplus food from growers that would not otherwise be able to donate to FoodCloud and to community partners. The Project seeks to facilitate donations from growers by contributing towards the costs of donation to provide a viable alternative to sending produce to animal feed that is perfectly good to eat, and to provide fresh nutritious produce to community partners.

FoodCloud has been testing different operational models for this project; initially supplying its own network on a small scale and then increasing in 2023 and 2024 to work with LDCs or larger food banks to redistribute larger quantities of vegetables and to access rural communities that it was not previously able to access (Donegal, Kerry and northwest Cork).

FoodCloud works with numerous community groups through the Growers' Project around the country and the results are very positive. Two examples considered here are Donegal and Kerry.

The **Donegal Food Response Network** co-ordinated by Donegal Local Development Company (DLDC) facilitates and supports a network of social enterprises, community groups, and volunteers delivering services and supports to the most disadvantaged, marginalised, and isolated members of society in Donegal. The Network is made up of 17 community partners who support people experiencing food poverty and food insecurity. It has seen very strong demand for its services and has struggled to meet demand throughout the county. This reflects the serious issue of food poverty. More than 3,000 individuals received the produce during the project.

A distribution model was set up by DLDC and the Donegal Food Response Network but it faces several challenges: funding challenges; volunteer staffing challenges; new

communities were not familiar with certain vegetables; and some users of the service did not cook, so cookery classes had to be considered. Funding the programme is an ongoing issue and various fundraising activities have to be undertaken on a continuing basis.

For the Donegal network, the main benefits of participating in the Growers' Project were the nutritional benefits from fresh food rather than canned or processed food; money savings on buying similar produce; reaching new beneficiaries; and adding variety to the existing service. Importantly, the project stopped the food going to waste and contributed to the growers' costs for donating the produce.

DLDC stated that *'Through this initiative with FoodCloud, the Donegal Food Response Network is able to redistribute fresh viable produce which otherwise would have gone to waste. This...pilot programme by FoodCloud has been really welcome as it is giving families the choice of getting fresh produce from the food bank instead of processed/canned food.'*

As identified in the *'Action Plan on Food Poverty'*, partnerships with LDCs like DLDC are crucial to supporting local communities but financial support for those groups is required to enable them to play a role in surplus food redistribution.

Foodshare Kerry acts as a foodbank and supply depot where the produce it collects is stored, sorted, graded and distributed to many community organisations. It estimates that 60 families per week receive the produce. The main benefits of participating in the Growers' Project was being able to add variety to the existing service, with the addition of good quality vegetables; saving money on buying similar produce; nutritional benefits; and reaching existing and new beneficiaries.

In relation to the Growers' Project, Foodshare Kerry stated: *'Excellent quality, good size and well packaged. Excellent type of vegetables chosen, core staples for families. Packaging and delivery were excellent, on time and excellent communication. The family sized packaging made a huge difference in the ease of transport and distribution.'*

In 2023 and 2024, over 320 tonnes of vegetables were redistributed through the Growers' Project. This was achieved by leveraging the partnerships with LDCs and groups like Foodshare Kerry to reach over 200 community groups across Ireland, 38 of which FoodCloud had not previously worked with due to their rural location. These new partnerships led to valuable insights into working with LDCs and provided another avenue for FoodCloud to share food efficiently and effectively. Over 160 community groups in FoodCloud's existing charity network were also able to benefit from the project.

With continued funding, FoodCloud could scale this project to 5000 tonnes annually by 2030 for an annual cost of approximately €3 million. That would avoid 9,000 tonnes of carbon emissions and provide the equivalent of 11.9 million meals to people who need it.

Table 6: FoodCloud Grower's Project 5-Year Projections

Environmental and social impacts	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnes of surplus to be redistributed	500	2000	3000	4000	5000
Approx. tonnes carbon emissions avoided	900	3600	5400	7200	9000
Approx. number of meals provided	1.2m	4.7m	7.1m	9.5m	11.9m

Source: FoodCloud

HYBRID FUNDING (GRANT AND PRIVATE) - UNITED KINGDOM

FareShare's Surplus with Purpose Fund (SwP) was launched in 2019, with the aim of reducing food waste in the UK. The scheme works with businesses across the food industry to help cover the extra costs of redistributing their unsold food to people who need it and preparing unfinished surplus food for redistribution. It helps companies to offset the costs involved in diverting edible surplus food to FareShare that otherwise may not have been sent for human consumption. The diverted food is safely redistributed to its network of almost 11,000 UK charities and community organisations who use it to create meals for their service users. Otherwise, this surplus food would often end up being ploughed back into the ground, used for animal feed, anaerobic digestion or sent to landfill.

The fund is open to UK-based: growers; farmers; producers; pack houses; processors; co-packers; importers; wholesalers; and retailers. The SwP fund works as follows:

- A business has food that cannot be sold, or food that has edible life left, but is not the finished product.
- The business offers the food but provides an explanation of the remaining costs involved.
- Fareshare accepts the offer and indicates the costs that it can cover.
- The required remaining work is carried out by the business.
- Foodshare collects and redistributes food to its network of charities and community groups.
- The business invoices Foodshare and receives payment from SwP towards its costs.

The costs that can be covered by the fund are those incurred for processes that allow a company to divert the food to FareShare, from the point at which it is commercially rejected.

Table 7 Example of 'Cost-Types' Acceptable under the SwP Fund

Waste Status at Point of Offer	Harvest Costs	Grading & Washing Costs	Packing Costs	Boxing & Palletising Costs	Transport Costs to FareShare
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In Field	Yes	Yes	Yes	Yes	Yes
Harvested Ungraded		Yes	Yes	Yes	Yes
Work in Progress			Yes	Yes	Yes
Packed Bulk				Yes	Yes
Finished Goods					Yes

The UK system is heavily dependent on government funding; in December 2024 it was announced that a grant scheme would be launched in 2025 for grants of £20,000 or more to the not-for-profit food redistribution sector in England (details are still to be confirmed).

FareShare welcomed the increased funding made available across Government departments including DEFRA and it 'looks forward to working with our parliamentary colleagues to ensure some of this funding can help get good food to people, instead of letting it go to waste.' Other funding comes from private donations.

TAX INCENTIVES - AUSTRALIA

Australia's National Food Waste Strategy sets a goal to halve the country's food waste by 2030. Food waste is a major problem in Australia. The environmental and economic consequences are laid out in the National Food Waste Strategy Feasibility Study:

- Food waste costs the Australian economy around AUD 36.6 billion on an annual basis.
- Every year Australians waste around 7.6 million tonnes of food across the food supply chain. This equates to an average household cost of AUD2,500 per year.
- Food waste accounts for around 3 per cent of Australia's GHG emissions.
- Australia uses around 2,600 gigalitres of water to grow food that is wasted.
- The amount of land used to grow wasted food covers more than 25 million hectares.
- At a sectoral level, households generate the most food waste, accounting for around 30 per cent of the total.

In 2020 KPMG produced a report on boosting food relief through the Australian tax system. At that time, the concept of a NFDTI (National Food Donation Tax Incentive) had gained significant support amongst the food relief sector, government stakeholders, consumer goods and agribusiness supply chain participants, and retailers. KPMG estimated that a NFDTI would have a direct cost to Federal Government revenue of approximately \$50 to \$100 million per annum, with large offsetting social, economic and environmental benefits of approximately \$2 billion per annum.

A tax incentive to donate food is seen as essential, because the cost of immediately disposing of food can be far lower than the cost incurred in donating food. In 2024, legislation proposing to implement the tax offset was introduced into the Australian Parliament. The proposed legislation would see food manufacturers and farmers receive a tax incentive for donating food to charity. With many farmers and food manufacturers struggling, the incentive is designed to offset the cost of getting food to charities.

TAX INCENTIVES - CANADA

Over half of food produced in Canada, or 11 million metric tonnes, is estimated to be lost and wasted annually.²⁰ Canada has attempted to address food waste through tax incentives for food donations. In addition, every Canadian province has enacted liability protection legislation to protect food donors from civil liability arising from food-related injuries. Under Federal law a charitable donation tax credit is offered to individuals and a charitable deduction for corporations. Claiming the tax credit is burdensome due to the difficulties associated with calculating the fair market value of the food that is donated. Corporations that donate food out of their inventory have to add the value of those goods to their income before deducting it, which effectively eliminates any financial benefit of the deduction.

At the provincial level other incentives are offered.

- In Ontario under the community food program, farmers are able to deduct 25 percent of the fair market value of the qualifying donation provided to an 'eligible community food program'.
- Quebec provides farmers with a tax credit of 50 percent based on the fair market value of products donated to food banks.
- Under section 20.1 of British Columbia's Income Tax Act, farmers who donate produce to food banks are entitled to a deduction of not more than 25 percent of the total amount of donation for the income year.
- Nova Scotia offers a food bank tax credit for farmers. It is a non-refundable income tax credit for both individuals and corporations that carry on the business of farming and donate agricultural products to an eligible food bank in Nova Scotia. The credit is calculated as 25 percent of the fair market value of the products donated.

TAX INCENTIVES - UNITED STATES

²⁰ The Global Food Donation Policy Atlas

The US approach is based on the premise that tax incentives make food donation more cost effective and economically beneficial.²¹

Food waste can qualify for tax deductions when it is donated to qualified nonprofit organisations.

The Protecting Americans from Tax Hikes (PATH) Act in 2015, all businesses, including C-corporations, S-corporations, limited liability corporations (LLCs), partnerships, and sole proprietorships are eligible for an enhanced tax deduction for food donations that meet certain eligibility criteria. If the donated food does not satisfy the criteria, it is still possible to claim a general tax deduction in the amount of the property's basis.

There are two types of tax incentive:

1. A general (non-enhanced) tax deduction allows businesses that donate inventory to claim a tax deduction in the amount of the property's basis, which is usually its cost to the business. This is often lower than the fair market value, which is the value at which the food can be sold. Businesses other than C-corporations cannot deduct more than 30 per cent of the business' total taxable income each year. C-corporations generally cannot deduct more than 10 per cent of their taxable income for the full year.
2. An enhanced tax deduction provides an extra incentive for donation by allowing the donating business to deduct the lesser of twice the basis value of the donated food or the basis value of the donated food plus one-half of the food's expected profit margin (if the food was sold at its fair market value). Under the enhanced deduction, all businesses may deduct up to 15 per cent of their taxable income for food donations.

The Natural Resources Defence Council and the Harvard Law School Food Law and Policy Clinic have recommended three suggestions to enhance the scheme:

- Federal tax incentives should be expanded to include an alternative tax credit that can be used by low-margin businesses, like many farms, in lieu of the enhanced deduction.
- Federal tax incentives should be strengthened by adding a deduction or credit specifically to cover the cost of transporting donated food.
- Congress should foster the development of innovative, sustainable food recovery models by repealing the 'no charge' provision that does not allow the enhanced deduction to be claimed if donated food is transferred by the donee in exchange for money, other property, or services.

²¹ US Food Waste Policy Finder

PRODUCER ORGANISATIONS - SPAIN

The Spanish Federation of Food Banks (FESBAL) is a non-profit, apolitical and non-denominational entity founded in 1995. It represents, promotes and supports the work of associated Food Banks in their fight against hunger, poverty and food waste, through distribution to the people most in need, while also contributing to improving the environment. Food Banks in Spain distributed a total of 138,046 tons of food through 6,493 social entities in 2023, which reached 1,187,976 beneficiaries, of which 21 per cent were children.²²

FEAGA (Fondo Español de Garantía Agraria or the Spanish Agrarian Guarantee Fund) is an autonomous agency of the Government of Spain, attached to the Ministry of Agriculture, Fisheries and Food, whose main mission is to ensure that the funds from the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) of the CAP assigned to Spain are strictly applied to achieve its objectives.

On 2 January 2025, the Food Losses and Waste Prevention legislation came into effect in Spain, with the key obligations to come into effect from 2 April 2026. The law includes an obligation on the part of the producer or distribution sector to donate surplus food that is fit for consumption. Food shops of more than 1,300m² will have to have agreements with food banks on non-governmental organisations to donate food that can still be used.

The hierarchy of action is:

- (1) Prevention with transformation when appropriate (processing of certain foods into other products such as creams or jams).
- (2) Donation for human consumption is the absolute priority for suitable food.

If the food is no longer fit for human consumption, it will be used in the following order for: Animal feed; By-products in other industries; or Composting or biofuels.

The legislation includes financial penalties for non-compliance of up to €500,000 for the most severe and repeated violations. The legislation establishes significant tax advantages for food donations by implementing a 0% VAT rate, which will be implemented in tax laws and regulations at a later date.

Producer Organisations form a key element of the food redistribution framework in Spain.

There is a serious asymmetry of bargaining power in the food supply chain in the EU. There are 11 million farmers, with many of those small family farms who operate independently of each other. In contrast there is significant concentration amongst both

²² Spanish Federation of Food Banks, Annual report 2023.

processors and retailers. To strengthen the bargaining power of farmers, the EU supports farmers who want to work together in Producer Organisations (POs). The EU also supports those who wish to work with their partners from the manufacturing and trading side of the food supply chain as part of what are known as interbranch organisations.

POs or associations of POs enable farmers to reduce transaction costs and collaborate when processing and marketing their products. POs strengthen the collective bargaining power of farmers by:

- Concentrating supply.
- Improving marketing.
- Providing technical and logistical assistance to their members.
- Helping with quality management.
- Transferring knowledge.

Recognised POs can benefit from exceptions from EU competition rules for certain activities, such as collective negotiations on behalf of their members, planning of production or certain supply management measures; and access to EU funding within 'operational programmes' in the fruit and vegetable sector, such as those to support collective investment in logistics for the benefit of their members.

Importantly for food banks, POs can make use of market withdrawals where produce is donated to food banks and the farmers are compensated for that produce by the EU (with a cap of 5 per cent of the farmer's annual production). In 2022, 19.8 million tonnes of food was withdrawn from the Spanish market, with 60 per cent of this going to food banks (with a value of €8 million).

The compensation from the EU to POs for market withdrawals includes transport so that farmers deliver to the FESBAL warehouses across Spain (up to 750 kilometres). However, there is no funding for the food banks to cover their own operational and administrative overheads under this mechanism. FESBAL is funded by private donations and receives very little government funding.

GRANT FUNDING & PRODUCER ORGANISATIONS - FRANCE

In 2016, the French government essentially banned food waste in grocery stores. Primarily in response to a spike in demand at food banks and other charities (spurred by an increase in unemployment and homelessness), France made it a law that grocery stores must donate edible food instead of throwing it out.

Any food nearing or past its best before date, which is still safe to eat, was previously thrown in the garbage and often intentionally spoiled with bleach or other chemicals to prevent 'dumpster diving'.

Today, grocery store managers violating the law face hefty fines and even jail time, which has led to a drastic reduction in food waste.

There are 79 food banks and 30 territorial branches throughout France. There are 7,000 volunteers and 600 employees who support 2.6 million people through 6,029 associations, social grocery stores and partner municipal social action centres.

From Field to Plate is a key part of the French approach. The food banks seek to guarantee sustainable, local and quality food aid thanks to a strong link with local stakeholders, particularly in the agricultural world. The system is based on a circular economy, a solidarity economy, the local economy, and the innovative economy. It comprises solidarity agricultural production, gleaning, shared gardens, processing workshops, transportation systems in rural areas, purchases of agricultural products, and promotion of agricultural professions.

The French system has a strong emphasis on creating social bonds involving all stakeholders, including local actors, the agricultural community, and food aid.

Under the *Better Eating for All* programme a multi-year fund has been created by the government aimed at improving the quality of food aid and the promotion of sustainable diets. In 2023, the programme was allocated €60 million available in:

- A national component, intended for the 18 national authorities authorised for food aid (€40 million).
- A local component aimed at grassroots associations fighting against food insecurity (€20 million).

The national component aims to increase the supply of food aid in fruits, vegetables, legumes, and products under quality labels. It aims to facilitate access to healthier and more sustainable foods, by respecting the seasonality of fresh products and by favouring a purchasing policy that promotes local sourcing and local organisations. The French Federation of Food Banks obtained €11 million, which will be used for the purchase of fruits, vegetables and legumes for the quality supply of all food banks.

The local component aims to develop actions around 4 axes;

- The development of local solidarity alliances between producers, associations, and communities.
- Supporting actions to combat food insecurity within territorial food projects.
- Support for experiments involving transforming how to fight food insecurity, such as sustainable food vouchers.
- Improving coverage of food aid where no specific planning proposal has been adopted.

Producer Organisations also supply the food banks in France through the same mechanism that exists in Spain.

SECTION 4: IRELAND – SUGGESTIONS FOR CREATING A FARM LEVEL REDISTRIBUTION MODEL

INTRODUCTION

Food loss and waste is a significant challenge facing global food systems. As outlined in this report it occurs at every stage of the supply chain and gives rise to significant social, environmental and economic costs. Properly targeted public policies can help address these challenges and augment the resilience of food systems, which would aid in food recovery, which would have positive social, economic and environmental consequences.

Scaling up food donation models requires aligned incentives that motivate individuals and companies to donate rather than discard surplus food.

An effective food donation model requires certain attributes.

- Food safety is an absolute priority.
- The food that is being donated needs to have full traceability, as food can be donated from all over the country in a 'hub and spoke' type model.
- The charity must have adequate transport that meets strict hygiene criteria.
- Charities must have adequate storage for the produce.
- Staff must have food safety training.
- Donors must go through a rigorous food safety process and be registered with the Department of Agriculture, Food and the Marine (DAFM) or other relevant regulatory body.
- The manner in which primary producers produce, store and package products is very important to ensure good quality and safe food.

To achieve maximum results and address the many issues associated with food waste, a multi-year funding programme should be created to generate certainty and continuity.

All participants in the Growers' Project interviewed for this report believe that it is a good effective way of addressing the challenge of food waste and food poverty. However, all agree that increased funding is required to allow producers to cover their costs in getting produce to FoodCloud. There is also a consensus view that the community partners are underfunded and struggle to build capacity in terms of volunteers, transportation and storage.

The production of horticultural output in Ireland is a challenging business that is affected by weather conditions; volatile output prices; high input costs in areas such as energy, labour, fertiliser, sprays and insecticides; margins are typically very tight; and there is considerable retailer concentration and power in the Irish retail grocery market. The number of horticultural producers in Ireland has been declining consistently for some years.²³

If farmers have surplus food production, they do not have the resources to make it available for food redistribution and instead either leave the crop in the ground and plough it back in or send it for animal feed or anaerobic digestion. From an environmental, social and economic perspective, these are not the optimal outcomes.

Redistributing surplus food to people who require nutrition but cannot afford it is very important. Farmers need to be incentivised to distribute the surplus food to food banks. Those incentives should cover basic costs of harvesting, packaging, transport, and the time commitment involved.

FOOD BANKING MODELS

The standard food banking model involves collaboration with primary producers, processors and manufacturers, distributors, and retailers to identify what food is available. The food bank then sorts, selects, and stores the food safely and then delivers that food to community organisations who distribute it to the people who need it. The food bank effectively acts as an essential intermediary, and they generally assume the responsibility to store and transport the food. To do this, a transport fleet, cold storage and a warehouse are needed.

Whatever the approach, food banks will continue to be the key player in the process and will need to have adequate and consistent resources to effectively carry out their valuable role in the community.

It is essential to have a system in place to scale up food donation and this requires aligned incentives that motivate individuals and companies to donate rather than discard surplus food.

There are 4 possible models of funding in an Irish context:

1. Tax incentives.
2. Direct funding from the State.
3. The UK Surplus with Purpose hybrid funding model.
4. Producer organisations.

²³ IFA, Retail Price Compression Threatens the Viability of Irish Horticulture, Jim Power Economics, March 2022.

TAX INCENTIVES

Leveraging tax law to motivate potential donors can encourage food donation and minimise the myriad costs associated with food loss and waste. Properly constructed, tax incentives can increase food donation, support innovative food rescue models, improve nutrition standards, and afford financial security to farmers and agribusinesses. It is vital that the tax incentives are not too bureaucratic as growers are already time-constrained. The tax incentives should cover the costs of production and distribution for the primary producer. However, tax incentives could also be used to encourage philanthropic donations to food redistribution NGOs and charities.

Canada, Australia and the US use tax incentives that are explained earlier in this report. The Global Food Donation Policy Atlas makes a number of strong recommendations in relation to tax policies. The key recommendations are that in order to position food donation as an economical alternative to simply discarding safe, surplus food:

- Include a charitable tax credit or deduction for in-kind food donation, not solely monetary contributions to registered charities.
- Ensure that the deductions or credits offered are not limited by deduction caps or other limitations that can severely reduce the significance of tax incentives for donors.
- Create a standardized methodology for clarifying fair market value (FMV) and allow donors to utilize FMV as a generous valuation for donated foods.
- Consider the additional costs associated with food donation—such as transportation—when designing tax incentives and include benefits that help offset these costs.

In order to ensure tax benefits are available to smaller-scale businesses and support innovative models of donation and healthier food donation, the key recommendations are:

- Offer a tax credit as a supplement or alternative to tax deductions to incentivize donation among small-scale, low-margin producers and businesses, such as farmers.
- Expand tax benefits to cover donations made to intermediaries and organizations that charge a nominal fee, to support emerging innovative models of food redistribution.
- Offer tiered tax benefits that place a higher value on healthy, nutritious food donations.

In order to alleviate the potential donation barrier posed by the application of VAT and minimize perverse incentives within the tax code to discard safe, surplus food, it is recommended to:

- Exempt food donation from the list of transactions that are VAT-taxable and ensure food donors are allowed to reclaim VAT credits attached to food that is donated.
- Restrict opportunities to deduct discarded food as a 'business loss'.

The Global Food Donation Policy Atlas cites the US and Colombia as the countries that have a strong tax incentive policy for food donations; Costa Rica, Mexico, Peru, and South Africa have moderate policies; and Argentina, Canada, Chile, Dominican Republic, and Guatemala have a limited policy.

DIRECT FUNDING FROM THE STATE

Direct funding from the state is the most straight-forward manner of incentivising surplus food redistribution. Grant aid has to be directed at: (i) producers to cover their costs; (ii) at the food charities to achieve adequate capacity; and (iii) to the NGOs who run the projects.

For a direct funding model to be most effective and to achieve maximum results and address the many issues associated with food waste, a multi-year funding programme should be created to generate certainty and continuity.

THE UK SURPLUS WITH PURPOSE HYBRID FUNDING MODEL

While there is no UK-wide grant funding opportunity at the national level, the countries of the UK offer several different funding opportunities for government support for food recovery and donation. The UK system is heavily dependent on government funding, but also relies on donations. The problem is the uncertainty and inconsistency of government funding.

PRODUCER ORGANISATIONS (POs)

Recognised POs can benefit from exceptions from EU competition rules for certain activities, such as collective negotiations on behalf of their members, planning of production or certain supply management measures; and access to EU funding within 'operational programmes' in the fruit and vegetable sector, such as those to support collective investment in logistics for the benefit of their members.

As of 2017, there were around 3,400 recognised POs in the EU, with 52 of those in fruit and vegetables. France had 724, Germany had 692, Italy had 583 and Spain had 579. In 2024 there are 5 POs operating in Ireland for vegetables, but not to any great extent for root vegetables.

As POs are not widespread in horticulture in Ireland, they are unlikely to work as a funding model for the redistribution of surplus agricultural produce and it is unlikely that POs will provide the whole solution for Ireland.

CONCLUSIONS FOR IRELAND

The demand for FoodCloud services is very strong. The FoodCloud survey from November 2024²⁴ shows that 84 per cent of charities who responded stated that they could use more fruit and vegetables if it could be sourced and delivered.

The demand is clearly there, it is just a question of creating an adequate and sustainable funding model for a food redistribution network.

As Producer Organisations are not widespread in horticulture in Ireland, they are unlikely to work as a funding model for the redistribution of surplus agricultural produce. The hybrid model used in the UK would not result in certainty and consistency and would represent a suboptimal solution.

In the short-term, the most appropriate approach for Ireland is direct funding from Government. To achieve maximum results and address the many issues associated with food waste, a multi-year funding programme should be created to generate certainty and continuity.

From its work to date, FoodCloud has the following indicative 5-year plan of what could potentially be achieved following a similar approach (i.e. scaling incrementally). The financial outlay is modest (approximately €3m per year from 2030), but the benefits from a social, economic and environmental perspective are very significant.

Table 8: FoodCloud Growers' Project 5-Year Projections

Environmental and social impacts	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnes of surplus to be redistributed	500	2000	3000	4000	5000
Approx. tonnes carbon emissions avoided	900	3600	5400	7200	9000
Approx. number of meals provided	1.2m	4.7m	7.1m	9.5m	11.9m

Source: FoodCloud

For an outlay of €3 million annually by 2030, 5,000 tonnes of surplus food would be redistributed annually; 9,000 tonnes of carbon emissions would be avoided; and 11.9 million meals would be provided to people who will benefit from this nutritious food.

In the longer-term, policymakers should move towards a model of tax incentives. Such a model should cover the costs of production and distribution for the primary producer. However, tax incentives could also be used to encourage philanthropic donations to food redistribution NGOs and charities. International examples of tax incentives for surplus

²⁴ FoodCloud Charity Survey 2024

food redistribution can be used as a basis for structuring a tax incentive model that would work in the Irish context.

APPENDIX 1 EUROSTAT DATA

Food Waste Estimations in the EU (2022)

SECTOR	TONNES FRESH MASS	%
Primary production	4.6 mln	7.8%
Manufacture of food products & beverages	11.1 mln	18.8%
Retail & other distribution of food	4.8 mln	8.1%
Restaurants & food services	6.6 mln	11.1%
Households	32.1 mln	54.2%
Total Food Waste	59.2 mln	100.0%

Source: Eurostat

Food Waste in the EU by Main Economic Sectors (Kg per Inhabitant 2022)

SECTOR	KG	%
Retail and Other Distribution of Food	11	8.3%
Primary Production	10	7.5%
Restaurants & Food Services	15	11.3%
Manufacture of Food Products & Beverages	25	18.9%
Households	72	54.5%
Total	132	100.0%

Source: Eurostat

APPENDIX 2 FOOD WASTE BY SECTOR OF ACTIVITIES 2022 (TONNES)

Food waste by sector of activities, 2022

(tonnes of fresh mass)

	Total food waste	Primary production	Processing and manufacturing	Retail and other distribution of food	Restaurants and food services	Households
EU	59 200 000	4 600 000	11 100 000	4 800 000	6 600 000	32 100 000
Belgium	1 758 589	33 863	737 026	125 564	111 250	750 886
Bulgaria	614 928	63 904	145 918	38 149	99 792	267 165
Czechia	1 080 608	14 670	165 414	67 296	180 773	652 455
Denmark	1 497 958	116 629	695 475	100 355	75 634	509 865
Germany	10 781 835	177 766	1 564 071	773 598	1 977 549	6 288 851
Estonia	180 747	21 555	39 088	19 681	12 930	87 493
Ireland	749 243	52 837	230 100	89 103	157 045	220 158
Greece ⁽¹⁾ ⁽²⁾	2 044 324	362 275	403 568	149 911	214 559	914 011
Spain ⁽²⁾ ⁽³⁾	4 260 845	845 620	1 419 257	348 219	213 023	1 434 726
France	9 450 000	1 179 000	2 406 000	830 000	1 091 000	3 944 000
Croatia	278 838	39 084	9 424	4 086	14 736	211 508
Italy ⁽²⁾	8 201 419	652 914	540 442	629 154	474 241	5 904 668
Cyprus	268 398	47 887	65 916	54 517	30 131	69 947
Latvia	232 442	27 226	29 917	15 759	25 183	134 357
Lithuania ⁽¹⁾	390 645	81 202	29 271	33 951	4 651	241 570
Luxembourg	79 406	7 582	11 430	8 614	9 626	42 154
Hungary	810 600	11 847	139 135	57 862	21 869	579 887
Malta	86 295	555	7 371	4 716	26 934	46 720
Netherlands ⁽²⁾	2 290 000	322 206	884 373	152 732	83 035	847 654
Austria	1 184 447	6 226	204 358	83 138	256 040	634 683
Poland	4 545 178	724 875	552 823	474 461	264 546	2 528 473
Portugal	1 926 484	110 980	64 572	227 908	239 000	1 284 025
Romania	:	:	:	:	:	:
Slovenia	150 839	58	10 587	14 070	55 839	70 285
Slovakia	574 824	36 225	141 776	30 144	11 918	354 760
Finland	607 709	29 439	139 297	52 828	81 182	304 963
Sweden	1 230 000	92 000	305 000	102 000	144 000	587 000
Norway	902 731	184 911	142 238	68 105	120 793	386 684
Iceland	60 587	29 065	1 596	1 927	3 856	24 143

(:) not available

Figures in italic are estimates

⁽¹⁾ 2022 data not reported, 2021 data presented

⁽²⁾ Definition differs in some figures

⁽³⁾ 2021 and 2022 data not reported, 2020 data presented.

Source: Eurostat (online data code: env_wasfw)

APPENDIX 3: FOOD WASTE BY SECTOR OF ACTIVITIES 2022 (Kg PER INHABITANT)

NACE_R2 (Labels)	Total (aggregate changing according to the context)	Primary production of food - agriculture, fishing and aquaculture	Manufacture of food products and beverages	Retail and other distribution of food	Restaurants and food services	Total activities by households
GEO (Labels)						
European Union -27	132	10	25	11	15	72
Belgium	151	3	63	11	10	64
Bulgaria	93	10	22	6	15	40
Czechia	101	1	15	6	17	61
Denmark	254	20	118	17	13	86
Germany	129	2	19	9	24	75
Estonia	134	16	29	15	10	65
Ireland	145	10	45	17	30	43
Greece	:	:	:	:	:	:
Spain	:	:	:	:	:	:
France	139	17	35	12	16	58
Croatia	72	10	2	1	4	55
Italy	139	11	9	11	8	100
Cyprus	294	52	72	60	33	77
Latvia	124	14	16	8	13	71
Lithuania	:	:	:	:	:	:
Luxembourg	122	12	18	13	15	65
Hungary	84	1	14	6	2	60
Malta	162	1	14	9	51	88
Netherlands	129	18	50	9	5	48
Austria	131	1	23	9	28	70
Poland	123	20	15	13	7	69
Portugal	185	11	6	22	23	123
Slovenia	71	0	5	7	26	33
Slovakia	106	7	26	6	2	65
Finland	109	5	25	10	15	55
Sweden	117	9	29	10	14	56
Norway	165	34	26	12	22	71

Source: Eurostat

APPENDIX 4: FOOD WASTE BY SUPPLY CHAIN SECTOR – IRELAND (2022)

Food Waste by Supply Chain Sector (2022)

STAGE OF FOOD SUPPLY CHAIN	TONNES OF FOOD WASTE GENERATED	% OF TOTAL
Primary Production	53,000	7.1%
Manufacturing & Processing	230,000	30.7%
Retail & Distribution	90,000	12.0%
Restaurants & Food Service	157,000	20.9%
Households	220,000	29.3%
Total	750,000	100.0%

Source: EPA Food Waste Statistics (June 2024)

Report 5 - Farm-Level Food Loss

Appendix 8 - Producer Organisation (PO) based valuation method

DAFM's Terms and Conditions of POs refer to rates being set by DAFM for PO market withdrawals. There are no rates available currently from DAFM; therefore to establish the market price of the type of produce that would be a market withdrawal from a PO, FoodCloud proposes to use the valuation method in the original legislation (although it is now left to the Member States to set the rate for all products, this was a process approved at EU level in the original legislation).

This assistance typically covers:

- a) Compensation for the value of the withdrawn products:
 - o up to a maximum amount set by EU regulations - €/100 kg of withdrawn produce (with specific products listed in Annex IV of Commission Delegated Regulation (EU) 2017/891 (EU 2017/891)).
 - o For those products not included in Annex IV of (EU 2017/891, DAFM shall set maximum at a level not exceeding 40% of the average market prices for the previous five years (free distribution).
- b) Flat rate amounts for sorting and packaging.
- c) Flat rate amounts for transport.

a) Compensation for the value of the withdrawn products

Maximum amounts of support for market withdrawals as referred to in Article 45(1) Commission Delegated Regulation (EU) 2017/891

Produce	Maximum support (EUR/100 kg)	
	Free distribution	Other destinations
Cauliflowers	21,05	15,79
Tomatoes (1 June - 31 October)	7,25	7,25
Tomatoes (1 November - 31 May)	33,96	25,48
Apples	24,16	18,11
Grapes	53,52	40,14
Apricots	64,18	48,14
Nectarines	37,82	28,57
Peaches	37,32	27,99
Pears	33,96	25,47
Aubergines	31,2	23,41
Melons	48,1	36,07
Watermelons	9,76	7,31
Oranges	21,00	21,00
Mandarins	25,82	19,50
Clementines	32,38	24,28

Report 5 - Farm-Level Food Loss

Satsumas	25,56	19,50
Lemons	29,98	22,48

Rates for other produce not specifically listed in Annex IV EU 2017/891

For those products not included in Annex IV EU 2017/891, DAFM shall set maximum amounts of support, comprising both the Union financial assistance and the PO contribution, at a level not exceeding 40% of the average market prices for the previous five years in case of free distribution and at a level not exceeding 30% of the average of market prices for the previous five years for destinations other than free distribution.

Annex V Commission Implementing Regulation (EU) 2017/892 laying down the rules for the application of Regulation (EU) No 1308/2013 with regard to the fruit and vegetables and processed fruit and vegetables sectors.

b) Flat rate amounts for sorting and packaging Article 17(1) and Annex V of EU 2017/892

Product	Sorting and packing costs (EUR/t)
Apples	187,70
Pears	159,60
Oranges	240,80
Clementines	296,60
Peaches	175,10
Nectarines	205,80
Watermelons	167,00
Cauliflowers	169,10
Other products	201,10

c) Flat rate amounts for transport Article 16(1) and Annex IV of EU 2017/892

Distance between the place of withdrawal and the place of delivery	Transport cost (EUR/t) ⁵⁷
Less than or equal to 25km	18,20
More than 25km but less than or equal to 200km	41,40
More than 200km but less than or equal to 350km	54,30
More than 350km but less than or equal to 500km	72,60
More than 500km but less than or equal to 750km	95,30
More than 750km	108,30

⁵⁷ Supplement for refrigerated transport €8.50 per tonne.

Report 5 - Farm-Level Food Loss

Appendix 9 - From Farm to Food Bank, Reimbursement of farmer's costs to redistribute surplus food

Proposal for the Common Agricultural Policy, European Food Banks Federation



From Farm to Food Bank

Reimbursement of farmer's costs to
redistribute surplus food – Proposal for the
Common Agricultural Policy

February 2025

European Food Banks Federation

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Introduction

In the EU, over 59 million tonnes of food waste are generated annually ([Eurostat, 2024](#)), with an associated market value estimated at 132 billion EUR ([SWD \(2023\)421](#)). Food waste is a huge environmental problem, accounting for about 16% of the total Greenhouse Gas emissions from the EU food system, while also wasting the water, nutrients and energy involved in production ([WWF UK, 2021](#)). At the same time, over 42 million European citizens cannot afford a quality meal every second day ([Eurostat, 2023](#)).

The agricultural sector is a cornerstone of the European Union, contributing significantly to rural livelihoods, cultural heritage, and food security. Farming activities provide employment for millions of people, and are fundamental to the vitality of rural and island communities across the European Union. Farming faces significant economic challenges, with issues such as price volatility, rising input costs, and increasing competition from global markets, all contributing to a complex environment for European farmers. Additionally, the increased frequency and intensity of extreme weather events are already negatively impacting agricultural production. ([EU CAP Network](#))

In this proposal the European Food Banks Federation – FEBA, representing Food Banks from across 30 European countries, advocates for the integration of farm payments covering or subsidising the cost of surplus food recovery from primary production into the Common Agricultural Policy (CAP). By securing financial support for farmers, this initiative aims to prevent food waste at its source and keep healthy, good quality food where it is needed in the human supply chain.

Food Banks across Europe tackle this issue daily by recovering and redistributing surplus good food to people in need. According to Eurostat, since 2019 the number of people at risk of poverty has been increasing from 92.4 million to 94.6 million in 2023, slowing down the previous trend to decrease poverty. ([Eurostat, 2024](#)) With a growing number of people in Europe struggling to make ends meet and to afford food, largely due to the poly-crisis effect of the COVID-19 pandemic and the cost-of-living crisis, the need to take action is clear.

Since 2021, FEBA also noted a steady increase in people requiring food assistance within its network, from serving 11.8 million people in 2021 to more than 12.8 million people in 2023. At the same time, FEBA observed a decrease in the amount of food redistributed, from 907,280 tonnes in 2021 to 839,942 tonnes in 2023. Alternative sources of food for this increasing number of people in need must be identified. Therefore, at the primary production stage, good quality, edible food that is unharvested or graded out due to low economic profitability or failure to meet aesthetic or marketing standards should not be diverted away from the human supply chain.

As far as possible, food fit for human consumption should and must be destined to feed people, instead of being ploughed back into the field, left to rot or given to animal feed, composting and anaerobic digestion (AD).¹ However, we at FEBA believe that food fit for human consumption should be considered food waste and be primarily destined to feed people in accordance with the food waste hierarchy ([JRC, 2024](#)), instead of being ploughed back into the field, left to rot or given to animal feed, composting and anaerobic digestion .

Evidence suggests that an average of 5 million tonnes of food waste was collected at the primary production stage in 2020 in the EU, making up 9% of the total amount of food waste, excluding the food that was not harvested ([Eurostat, 2021](#)). However, limitations have been observed regarding the quantification of food loss and waste in primary production ([WRAP 2019](#); [WWF 2021](#); [2022](#)). Research from WWF UK and Tesco on the scale and impact of food waste in primary production indicates that the true figures of food loss and waste are hidden when it comes to the farm level, however estimations in the UK alone show that 3.3 million tonnes of food are lost and wasted on farms each year ([WWF UK, 2022](#)).

The following case studies and best practices from Food Banks in our membership unveil the potential and opportunities to recover surplus food from primary production for human consumption, creating substantial positive effect on the climate and people in need.

As mentioned in the [Vision for Agriculture and Food](#), food poverty as well as food waste needs to be addressed. The aim of this proposal is therefore in line with the vision, in that its goal is to benefit both farmers and people in need.

Best Practices

Ireland: “The Growers’ Project”

FEBA Member FoodCloud in Ireland, together with The Department of Agriculture, Food and the Marine (DAFM) and the private sector, has been running a pilot project for surplus recovery from farms since 2022. The fund supports farmers to recover food that is either unharvested, graded out for not meeting retail specifications or which is in excess of consumer demand but is edible and should go towards human consumption. During the pilot, FoodCloud engaged with 8 farmers and established that there were significant quantities of surplus available. They have piloted different models; redistributing some of the surplus through new partnerships with three local development companies (LDCs) in Donegal, Kerry and Cork and through FoodCloud’s existing charity network ([Agriland](#)). The initial pilot recovered 30 tonnes of food from farmers in Ireland. That was scaled up to over 90 tonnes in 2023 and over 230 tonnes

¹ Although empirically surplus food from primary production, especially before harvest, is considered as [food loss](#) instead of [food waste](#) (FAO definitions).

in 2024, a total of over 800,000 meals equivalent, saving approximately 805 tonnes of CO2 equivalent emissions from going to waste ([FoodCloud](#)).

In his assessment of the Growers' Project, Jim Power (Agro-Economist) stated that overall, all stakeholders involved in the project see the positive effect on food waste and poverty that results from this activity. However, more funding is necessary for farmers to cover their costs. According to him, the costs the Grower's Project at scale over 5 years is estimated to cost €2.36 million, of which, €1 million is for costs to farmers and €1.36 million to cover FoodCloud's redistribution costs. Due to the largely voluntary nature of Food Banks and charities, they would be unable to build or sustain the capacities needed to recover surplus food from primary production on a regular basis by themselves. He also pointed out the need to incentivise routes to human consumption, as it is currently cheaper to leave the crop in the ground and plough it back into the soil, or to send it for farm feed or AD. In conclusion, he recommends that this nutritious food should reach people in need and the funds should cover the basic costs of harvesting, packaging, transport, and the time commitment involved ([Jim Power Economics](#)).

FoodCloud CEO and Co-Founder Aoibheann O'Brien pointed out, "(...) Our target is to redistribute produce that would not otherwise have been harvested, or which might have been sent for animal feed. During the pilot we discovered that there are large volumes of surplus produce that are currently not reaching the market, and therefore the project presents a huge opportunity to act against climate change by reducing food waste while supporting vulnerable communities with access to nutritious, high quality, Irish vegetables." Aoibheann continues, "Farmers are crucial partners in this shared effort and our experience so far is that growers are keen to play their part in tackling this important environmental issue. Farm level loss is significant globally and in Ireland, and this project supports the new National Strategy for Horticulture 2023-2027, the National Food Waste Prevention Roadmap, Food Vision 2030, and the Waste Action Plan for a Circular Economy" ([FoodCloud](#)).

Speaking on the International Day of Awareness of Food Loss and Waste in September 2023, then Minister for Agriculture, Food and the Marine Charlie McConalogue said, "I am delighted that we can continue to support projects in rural areas in reducing food waste and contribute to our commitment to reduce the amount of food we waste in accordance with the United Nations Sustainable Development Goals. Food waste costs the average Irish home approximately €700 per year and it is estimated that between 8% and 10% of global greenhouse gas emissions are because of food waste. So, by tackling food waste we improve the climate while saving money."

Lithuania

FEBA Member Maisto Bankas in Lithuania has actively recovered surplus from farms since 2019. They have since scaled up these efforts and received some help and funding from the Ministry of Agriculture.

The Ministry of Agriculture of Lithuania has been supporting charities since 2022 to contribute to reducing food losses and helping the people in need. For this purpose, the Ministry planned to allocate €600,000 in 2024 ([Ministry of Agriculture](#)). According to the Food Bank, in 2023, the amount of food recovered from the agricultural sector doubled, which now amounts to 12% ([Maisto Bankas](#)). The aforementioned financial support is provided to charities for the management of food collected from food business operators (primary production and the food industry). The support amounts to 50% per kilogram of food collected and subsequently donated to charity. In 2022, more than €130,000 were allocated. More than 350 tonnes of surplus food have been redistributed, including 150 tonnes of farmers' produce and more than 200 tonnes of food industry products. Support will also be provided in 2025.

Table 1: Years of government funding for surplus recovery from primary production Lithuania.

Year	Funding	Total
2022	€130,000	350 tonnes
2023	€400,000	800 tonnes
2024	€500,000	(Goal) 1000 tonnes

The legal requirements for the funding are structured as follows:

- The amount of the aid may not exceed EUR 0,5 per kilogram of food collected from food business operators and subsequently given to charity and food aid and/or still in storage (...)
- The maximum amount of aid to be paid to the applicant shall be calculated by multiplying the amount of food to be collected in kilograms over the period of time specified in the application by EUR 0,5.
- The final amount of aid to be paid to the beneficiary for food preserved during the entire period of support shall be calculated on the basis of the costs actually incurred by the beneficiary for the preservation of one kilo of food in the context of the activities supported under the Rules, up to the maximum amount of the aid to be paid.
- Value added tax (VAT) shall not be an eligible expenditure under these Rules, unless it is paid by the beneficiary, who is not subject to VAT, on the value of the goods and/or services to be acquired/acquired/imported and undertakes not to seek its recovery from the State budget.

([Lithuanian Legislation](#))

United Kingdom: “Surplus with Purpose”

While the UK is no longer an EU Member State, we believe it relevant to consider wider developments in our European network, especially where there is considerable progress on the redistribution of surplus from primary production.

"Surplus with Purpose" (SWP) is a campaign launched by FEBA Member FareShare UK in 2019 that aims to reduce food waste by redistributing surplus food to charities and community organisations that need it. It is a way of addressing both food insecurity and food waste at the same time. Surplus with Purpose helps FareShare redistribute thousands of tonnes of surplus fresh fruit and vegetables to charities and community organisations. Otherwise, this surplus food will often end up being ploughed back into the ground, used for animal feed, or sent for AD ([FareShare](#)).

Looking at SWP specifically, its activities in the primary production sector are significant. Following the launch of SWP in 2019, Fareshare was able to recover much greater quantities of produce, growing from approximately 2,000 tonnes of produce to more than 10,000 tonnes of produce by 2023 (Figure 1). The fund is open to UK-based growers, farmers and producers and helps to offset the costs involved in diverting edible surplus food to FareShare.

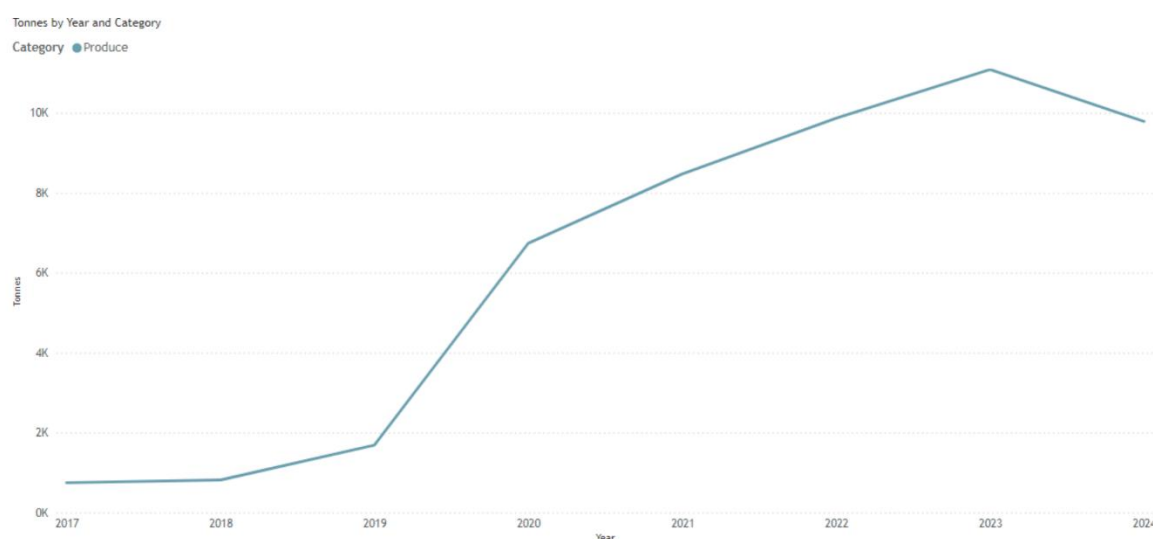


Figure 1: Tonnes of produce (fruits & vegetables) received since 2017 (Source: FareShare UK).

In December 2024, the Department for Environment, Food & Rural Affairs (DEFRA) announced £15 million to help charities receive surplus produce from farms to those in need. Around 330,000 tonnes of edible food is wasted or fed to animals in the UK each year before leaving farms ([DEFRA](#)). According to DEFRA, farmers would prefer for the surplus food to be destined for people's plates. Charities that redistribute food often lack the means to collect food from farms and give it to those who need it. To

strengthen the links between farms and charities and help solve the problem of farm food waste, the funding will go towards initiatives such as SWP of FareShare to support the recovery.

Proposal: Recommendations for the Common Agricultural Policy Post 2027 - Pillar II

Citizens' opinions on the CAP are in strong favour and highlight key topics of importance such as environmentally- friendly practices and a sustainable future ([Eurobarometer, 2024](#)).

Research for the AGRI Committee from the European Parliament on the objectives and contents for the next CAP (2028-2034) highlighted that addressing climate and environmental societal challenges in Pathways D and E requires a significant increase in the CAP budget, as well as in other areas notably to favour consumer diet changes and waste reduction (food policy), and to enable the poorest households to access healthy foods and diets thanks to social transfers (social policy). ([National Research Institute for Agriculture, Food and the Environment \(INRAE\) and The Institute for Sustainable Development and International Relations \(IDDRI\) for the European Parliament](#))

The Common Agricultural Policy of the European Union, under its current programming period, contains various elements for environmental sustainability. The comparison of the Eco-schemes under CAP Pillar I and the Agri-environment-climate commitments under CAP Pillar II provide a good understanding of the different levels of engagement and funding available.

Table 2: Comparison of key aspects of “Eco-Schemes” in CAP Pillar I and “Agri-Environment-Climate Commitments” in CAP Pillar II ([Source: European Commission](#)).

	Eco-schemes	Agri-environment-climate commitments
Source of funding	Pillar I budget – without co-financing by Member States	Pillar II budget – with co-financing by Member States
Possible beneficiaries	Farmers	Farmers, other land managers (e.g. environmental NGOs)
Payments' link to land	Payment per hectare Land concerned must be eligible for direct payments	Payment per hectare Land concerned need not be eligible for direct payments
Obligatory/voluntary?	Member States must make provision for them Participation voluntary for farmers	Member States must make provision for them Participation voluntary for farmers and other potential beneficiaries
Nature of commitments	Annual (i.e. “one year at a time”)	Multi-annual contracts (usually of 5-7 years)

Calculation of premia	Compensation for additional costs/ income losses arising from commitments concerned, OR Additional payment to basic income support (no particular rules over premium level)	Compensation for additional costs / income losses arising from commitments concerned
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FEBA would propose financing surplus recovery under the Agri-environment-climate commitments of Pillar II as co-financing with Member States for surplus recovery from primary production, targeting specifically crops that are not economically profitable to be harvested or do not fit the aesthetic requirements of the market:

- As some Member States already engage in the financing of such activities, as presented in the best practices from Ireland and Lithuania, this could then be matched by the European Union.
- Beneficiaries could therefore be farmers offsetting their costs in harvesting surplus and/or processing surplus produce that does not meet retail specifications or is in excess of consumer demand, as in the case of Ireland, or environmental NGO's such as Food Banks for recovering the leftover food from the farmer like in the case of Lithuania.
- In the national grants the payments are linked to the tonnes of food recovered (as in the case of Lithuania) from the farmland, which could serve as example for method of compensation in the CAP.
- The voluntary nature of participation gives farmers and Food Banks the opportunity to explore possible options to collaborate and to ensure that the food reaches people first offering an alternative avenue to AD for surplus food that is still edible, so nutritious food can reach people who need it.
- The nature of commitments would also be favourable for vulnerable individuals and communities as it would ensure a steady income of fresh fruits and vegetables for people that need it. This consistency would also improve the nutritional value that Food Banks can offer to charities, partner organisations and end beneficiaries.
- When it comes to additional costs or losses arising from these commitments, these should never exceed the funding available and only focus on what can be harvested with the funding at disposal. In addition, Food Banks have a vast network of professionals and volunteers of 98,662 co-workers, 94% of whom are volunteers, that can be included in the process to ensure cost-effectiveness.

- The CAP Pillar II offers many types of payments for the environment and climate including those for cooperation (e.g. for farms to jointly supply waste for sustainable energy production) ([European Commission](#)). FEBA believes that tertiary uses like animal feed and AD are appropriate ways to make use of surplus food not fit for human consumption, but in the case of edible food, the first priority should be to people who need it. In this respect, the relationship of the food industry towards AD is currently skewed. Subsidies to AD including the CAP and national subsidies far outweigh any government support given towards directing surplus food towards people. This distorts the market and financially incentivises the sending of fresh good food to animal feed or AD rather than charities. More importantly the volume of subsidies to AD contradicts the EUs own recommendations in their food waste hierarchy of the importance of redistribution for human consumption ([JRC, 2024](#)). In the meantime, farmers and food businesses continue to face barriers getting their surplus food to charities and Food Banks.

Conclusion

In 2023, 94.6 million people in the EU (21% of the population) were at risk of poverty or social exclusion ([Eurostat, 2024](#)). Many of them are experiencing severe material deprivation. Food Banks work tirelessly to bridge the gap between the growing demand from charities and people in need with the food donations and surplus from retail and manufacturing.

Recovering food that would otherwise have not been harvested, would have been graded out for not meeting specifications or is in excess of consumer demand would therefore not only offer Food Banks a source of fresh and nutritious fruits and vegetables, which is hard for them to receive, but would also help to reduce emissions and while aligning with the food waste hierarchy, which favours human consumption and redistribution over animal feed and AD. It would therefore have a social and environmental impact as well as supporting farmers for their additional costs in making the surplus food available.

Authors' Note

Food Banks in the network of FEBA in various countries benefit from the EU Fruits & Vegetables Withdrawal scheme ([Implementing Regulation \(EU\) 2022/1863](#)) in France, Portugal, Spain, Belgium and Italy. However, this scheme is only possible where large agricultural production and withdrawals occur. Its purpose is also to regulate overproduction and market fluctuations; therefore, it is rather economic in nature and not aimed at recovering surplus from primary production. Because only 5 out of the 22 FEBA EU Food Banks benefit from this possibility, a more targeted approach in tackling food waste at farm stage would be favourable.

A dedicated fund to recover surplus from primary production would therefore ensure that each Food Bank across Europe has the possibility to collaborate with farmers, and each farmer the possibility to offset his costs for harvesting what is not profitable.

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References

- [European Commission, Food Waste Statistics, 2024](#)
- [European Commission, Impact Assessment Report on the Revision of the Waste Framework Directive, 2023](#)
- [Eurostat, Inability to afford a meal with meat, chicken, fish \(or vegetarian equivalent\) every second day, 2024](#)
- [Food and Agricultural Organisation \(FAO\), Introduction Food Loss and Waste, 2024](#)
- [European Commission Joint Research Centre \(JRC\), Building evidence on food waste prevention interventions, 2024](#)
- [Eurostat, Food waste and food waste prevention by NACE Rev. 2 activity - tonnes of fresh mass, 2021](#)
- [EUFIC, Food waste in Europe: statistics and facts about the problem, 2024](#)
- [Agriland, €165,000 in funding for food waste reduction project, 2024](#)
- [FoodCloud, FoodCloud Collaborating with Farmers to Redistribute Food Waste for Enough Meals to Feed a Full Croke Park and Aviva Stadium Combined, 2023](#)
- [Government of Ireland, Minister McConalogue announces funding for food waste reduction project, 2023](#)
- [Jim Power Economics, Recommendations for an Agricultural Surplus Redistribution Programme in Ireland, 2025](#)
- [Government of Lithuania, The Ministry of Agriculture will again allocate support to charitable organizations, 2024](#)
- [Maisto Bankas, Annual Report 2024](#)
- [Lithuanian Legislation](#)

- [United Kingdom Government, £15 million to help charities get spare produce to those in need, 2024](#)
- [£15 million to help charities get spare produce to those in need - GOV.UK](#)
- [FareShare UK, About the FareShare Surplus with Purpose Fund, 2024](#)
- [European Commission, The Post-2020 Common Agricultural Policy: Environmental benefits and simplifications, 2025](#)
- [Eurostat, People at risk of poverty or social exclusion in 2023, 2024](#)
- [European Commission, Implementing Regulation, 2022](#)

Report 5 - Farm-Level Food Loss

Appendix 10 - Supplementary data

from O'Connor, T., Kleemann, R. and Attard, J. (2022) 'Vulnerable vegetables and efficient fishers: A study of primary production food losses and waste in Ireland', Journal of Environmental Management, 307, 114498

In Appendix 10, Table 1, FoodCloud has classified the FLW in field vegetables, protected vegetables and fruit as either edible or not edible (using the category headings). This was reviewed by O'Connor in November 2025 and confirms of the total 126,199 tonnes of surplus produce:

- 94,877 tonnes is edible surplus produce (75%).
- 31,322 tonnes is non-edible produce (25%).

Removing fruit from this analysis: edible produce represents 78% and non-edible is 22%.

A further table calculates the edible total of 94,877 tonnes out of the total 2020 production tonnage for that produce (602,286 tonnes) which highlights that there is a potential increase in domestic horticulture production with utilisation of edible FLW of 15.8%.

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Appendix 10, Table 1

Table S4: The FLW percentages, annual quantities, and associated causes in the field vegetable sector (incl. = including, white = loss, grey = waste).

Food	FLW (%)	FLW (t/a) - Edible	FLW (t/a) - Not Edible	FLW Cause
Potato	7.5	34143		Harvesting losses - too deep or fall out of the harvester
	5	22762		Not marketable (go for cattle feed)
	3	13657		Store losses due to moisture losses
	0.5		2276	Diseases (incl. gangrene, pink rot, soft rot, dry rot)
Carrot	Invisible		0	Potato cyst nematode
	7.5		4895	Pests and diseases (cavity spot, fusarium, sclerotinia)
	5	3263		Breakages
	5	3263		Deformities (forking and fanging)
Parsnip	10		6527	Extreme weather (frost, flooding)
	15		1302	Canker
	5	434		Mechanical damage
	5	434		Deformities (forking and fanging)
	15		466	Diseases during drying, curing and storage
Onion	10	699		Damaged and out of specifications
	unknown		0	Change in supermarket specification requirements
Outdoor lettuce	40		1434	Weather conditions resulting in damage or a change in harvesting schedule, weather-related diseases, availability of imports in autumn under-cutting market for Irish product
Cabbage	15	4663		Variable demand and availability
	10		3109	Pests and diseases (mostly in autumn and winter due to weather conditions)
Broccoli	20	1776		Unplanned production due to shifts in weather
	5		444	Weather (snow, extreme wind, drought, waterlogging)
	2.5		222	Pests and disease (in field)
	2.5		222	Pests and disease (in storage)
	5	444		Supermarkets cancel orders at the last minute
Cauliflower	20	1178		Unplanned production due to shifts in weather
	5		294	Weather (snow, extreme wind, drought, waterlogging)
	2.5		147	Pests and disease (in field)
	2.5		147	Pests and disease (in storage)
	5	294		Supermarkets cancel orders at the last minute
Swede	8	2208		Not meeting customer specifications, misshapen
	6		1656	Pests and disease (Dry rot or Phoma, crater spot), nutritional deficiencies (Boron deficiencies), weed control (50% are hand harvested therefore unsaleable swedes are left in the field)
	6		1656	Pests and disease (Dry rot or Phoma, crater spot), nutritional deficiencies (Boron deficiencies), weed control (50% are machine harvested therefore waste is post-harvest)
Brussels Sprout	25		767	Bacterial breakdown due to wet weather at harvesting, pest and disease, grade outs

Table S6: The FLW percentages, annual quantities, and associated causes in the protected vegetables sector (white = loss, grey = waste)

Food	FLW (%)	FLW (t/a) - Edible	FLW (t/a) - Not Edible	FLW Cause
Mushroom	7.5	5659		Supermarket request stalks cut off for aesthetic reasons
	2		1509	Disease
	unknown		0	Poor quality mushrooms
Tomato	4		165	Unsaleable fruit (damaged, overripe), Unskilled workers, Supermarket returns due to quality
	1		41	Pests and diseases
Indoor lettuce	5		240	Change in consumer demand, eg a wintry summer week, Pests and diseases

Table S8: The FLW percentages, annual quantities, and associated causes in the fruit sector (negl = negligible, white = loss, grey = waste)

Food	FLW (%)	FLW (t/a) - Edible	FLW (t/a) - Not Edible	FLW Cause
Apple (fresh)	15		2255	Storage rot and disease
Apple (processing)	0.6		42	Rot/disease pre-harvest
Strawberry	11.7		794	Disease (particularly mold and mildew)
	10		599	Small or unripe fruit
	1.5		91	Insects
	negl.		0	Storage rot and decay
Cumquat	5		8	Fallen fruit
Raspberry	2		7	Disease
	2		7	Insects
	negl.		0	Storage rot and decay
		FLW (t/a) - Edible	FLW (t/a) - Not Edible	
Total		94877	31322	

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Appendix 10, Table 2

Food	Production estimate 2020 (excl. FLW) (t/a)
Potato	382400
Carrot	47320
Parsnip	6510
Onion	3496
Outdoor lettuce	2151
Cabbage	23314
Broccoli	5772
Cauliflower	3828
Swede	22080
Brussels Sprout	2300
Mushroom	68290
Tomato	3924
Indoor lettuce	4551
All categories of fruit	26350
Total	602,286
Edible Total	94,877
Edible Total/Production Total = Potential increase in domestic horticulture production with utilisation of edible FLW	15.8%