Scoping potential food waste in the Irish fruit & vegetable supply chain

Key findings thus far[1]

- Substantial waste biomass is generated across the fruit and vegetable supply chain in Ireland each year.
- An estimated **300,000 - 360,000 tonnes** (on average) was generated at farm, distribution and processing level in 2018 from **14 key Irish crops** (Table 1).
- In **excess of 200,000 tonnes** of this relates to **potatoes alone**.
- **45-70%** of key **Irish vegetable crops** is potentially wasted each year (on average).
- **< 25%** of key **Irish fruit crops** is potentially wasted each year (on average).
- A further **40,000 - 60,000 tonnes** of waste is potentially generated from **imported produce** of the same 14 crops.
- Ireland imports a wide variety of other fruits & vegetables (not considered in these figures).
- Many factors affect wastage in the supply chain and these vary considerably between crops & from year to year.

Project focus

Minimising food waste in the Irish agricultural sector is a key priority for the EPA. The global fruit and vegetable processing and supply chain generates a large amount of waste that typically becomes a financial and environmental burden to the operator. However, relatively little is known about the levels of fruit and vegetable waste that are generated during the pre-consumer stage of the supply chain in Ireland and this knowledge probably only extends to a small fraction of what is potentially lost from the Irish food supply chain every year.

With support from EPA Green Enterprise funding and expertise from ECOS Environmental Consultants, CyberColloids has embarked on a study that will (i) scope the extent to which fruits and vegetables are lost or wasted from the food supply chain in Ireland; (ii) identify the current strategies and barriers for disposal and/or reuse; (iii) screen targeted resources for potential upgrade into new food fibre ingredients and (iv) offer recommendations to the Irish industry that will aid in developing waste management and sustainability programmes.

Table 1. Estimated annual production and losses (tonnes) for key Irish fruit and vegetable crops at farm and distribution/processing level, showing potential biomass for upgrade

Crop	Yield per annum	Min loss at farm level	Max loss at farm level	Min loss at distribution	Max loss at distribution	Max biomass
Potato	364,050	54,608	109,215	92,833	123,777	**247,392**
Carrot	49,595	7,439	14,879	12,647	16,862	**31,741**
Apple	19,964	998	2,995	5,690	7,586	**22,981**
Cabbage	16,436	2,465	4,931	4,191	5,588	**15,119**
Onion	7,486	1,123	2,246	1,909	2,545	**14,191**
Swede	12,650	1,898	3,795	3,226	4,301	**8,096**
Turnip	7,335	1,100	2,201	1,871	2,494	**4,694**
Parsnip	6,342	951	1,903	1,617	2,156	**4,059**
Broccoli	4,790	719	1,437	1,222	1,629	**3,066**
Kale	4,249	637	1,275	1,158	1,544	**2,719**
Strawberry	4,064	203	610	1,084	1,445	**2,154**
Leek	2,806	421	842	700	933	**1,796**
Cauliflower	2,405	361	722	590	786	**1,539**
Brussels sprout	1,728	259	518	422	563	**1,106**
Total	**503,900**	**73,182**	**147,566**	**129,159**	**172,212**	**360,653**

Potential for use as new food fibre ingredients

Utilising in-house expertise and building on knowledge developed under two previous EPA Green Enterprise funded projects[2-4], CyberColloids is in the process of evaluating the 14 key crop biomass resources for potential upgrade into new food fibres ingredients.

The potential to produce 3 types of prototype fibres is being evaluated. This is dependant on the compositional make-up of each the biomass resource. **Untreated fibres** are prepared from all resources using controlled drying and milling. Physical treatment can then be applied to promote the functionality of the cellulose component and to produce **fibres with water binding properties**.

Untreated fibres derived from raw materials containing pectin are also treated with a proprietary process to activate the pectin and to produce **fibres with the potential to form gels**. Table 2 gives an overview of where we are with the processing and how the application of physical treatment and pectin activation has improved the functionality of different fibres. We have added tomato to the list for evaluation, as one of the key imported crops with an interesting biomass.

Challenges

Biomass resources are typically highly variable in their nature and composition. Depending on season, place of origin, where in the supply chain they have come from and whether they are whole, trimmed, processed (*i.e.* skins, peels, stalks, florets, flesh, with or without pips and seeds). The processes we have developed also have variable impact on promoting functionality across these different types of biomass. Any recommendations for future upgrade biomass from the Irish fruit & vegetable supply chain will therefor have to take this into consideration.

Crop	Improved water binding	Gelling ability
Carrot	++	++
Apple	+	+
Cabbage	++	
Onion	+	+
Swede	++	++
Parsnip	+	
Broccoli	++	
Strawberry	+	++
Cauliflower	++	
Tomato	+	++

Table 2. Fibres produced from 10 resources to date. + indicates where functionality has been improved with processing, ++ indicates where improvement is sufficiently good to worthy further investigation.

Next steps

- Produce fibres from the remaining biomass resources.
- Complete functional evaluation of all fibres.
- Benchmark interesting fibres against market available products in order to establish any future commercial potential.
- Produce recommendations for the Irish fruit and vegetable industry and relevant stakeholders.
- Deliver our findings at The EPA's National Waste Prevention Programme Green Enterprise event in May 2020.

1. ECOS (2019). Irish Fruit and Vegetables Potential Supply Chain for Valuable Biomass Resources: Scoping the Potential Resource. Report to CyberColloids. November 2019.
2. Vegetable Waste a Rich Resource – research update 2015.
3. A New Look at Carrot Waste – research update 2017.
4. A New Look at Carrot Waste – research update 2018.

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