



**A Nuffield Farming Scholarships Trust
Report**

Award sponsored by

John Oldacre Foundation

**Eat your sprouts! Tackling the
food waste issue**

Maeve Whyte

August 2016

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NUFFIELD FARMING SCHOLARSHIPS TRUST (UK)

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A Nuffield (UK) Farming Scholarships Trust Report



Date of report: August 2016

*"Leading positive change in agriculture.
Inspiring passion and potential in people."*

Title	Eat your sprouts! Tackling the food waste issue
Scholar	Maeve Whyte
Sponsor	John Oldacre Foundation
Objectives of Study Tour	<ul style="list-style-type: none">• To investigate food waste on farm and the impact this has on growers and their businesses.• To look at where innovative steps have been taken to reduce food waste and highlight some inspiring solutions.• To assess the barriers to finding ways of reducing food waste on farm.
Countries Visited	UK, Italy, Belgium, Ireland, United Arab Emirates, USA.
Messages	<p>Reducing food waste is a 'movement' that is engaging the public, policy makers and politicians. Farmers should therefore be thoroughly engaged in helping to shape solutions, opportunities and outcomes.</p> <p>My research indicates that the most successful projects to reduce food waste are often those that are carried out in partnership with either other farmers or other members of the food chain. Cooperation is therefore vital.</p> <p>I also believe that farmers need to be more proactive and see solutions as an opportunity. Reducing food waste at farm level does not have to be rocket science but does require thought, investment, ingenuity and courage in various measures.</p>

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DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor, or of any other sponsoring body.

CONTACT DETAILS

Maeve Whyte,
25 Rue Washington,
1050
Brussels

Maeve.whyte@nfu.org.uk

0032 479 273 569

Nuffield Farming Scholars are available to speak to NFU Branches, Agricultural Discussion Groups and similar organisations

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Southill Farmhouse, Staple Fitzpaine, Taunton TA3 5SH
Tel : 01460 234012
email : director@nuffieldscholar.org
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1. Personal introduction

After studying for a master's degree in Environmental Technology at Imperial College London, I started my career with the National Farmers' Union (NFU) England and Wales in 2001. I began in the environment department, mainly dealing with water and climate change policy. In 2006, I became Director of the British Agriculture Bureau (BAB) in Brussels which represents all of the UK farming unions. I deal with a diverse range of policy that impacts on our members in the UK and make sure that our lobbying is coordinated, professional and effective.



Figure 1 The author, Maeve Whyte

For many years our office has hosted groups of Nuffield Farming Scholars in Brussels who come to learn about how EU farming policy is developed and to pick the brains of those at the heart of that policy making process. I had always secretly hoped to be one of them but wanted to make the most of the opportunity by choosing a subject that combined my passion for food, farming and the environment. Not only did food waste fulfil that brief, but having grown up in a house where nothing was allowed to be left on the plate, I knew it was a topic that would also make my mother proud!

Working on policy making in Brussels can shield you from the realities of life on the ground. My Nuffield Farming experience has given me a wonderful opportunity to reconnect with how modern farming operates today. Not only have I met many wonderful, inspiring people, I also now believe that I understand better the horticulture sector at home in Ireland and in the UK.

I am from Rush, a small seaside town in North County Dublin. Rush has developed into a commuter town for Dublin but horticulture remains vital to the prosperity of the local economy. I live in Brussels with my husband John and our two beautiful babies Eoghan and Laragh.



2. Rationale for my study and countries visited

"I haven't been everywhere, but it's on my list." – Susan Sontag

2.1. Farmers leading from the front

Over the past number of years, the Brussels agricultural agenda has been dominated by discussions on environmental concerns including climate change, the need to produce more but impact less, and food security. Food waste has therefore advanced up the political agenda as it not only results in the loss of valuable nutrition, but also the loss of finite resources such as energy, water and land that are required to produce our food.

The issue has not only gained traction amongst policy makers but consumers and politicians are also becoming more aware of the problem due to public facing initiatives in the UK including Feeding the 5000, the Pig Idea and campaigning by celebrity chefs.



Figure 2: Enjoying a free meal at the Feeding the 5000 event in Brussels

Previous experience indicates that where farmers have not been at the forefront of developments relating to food and its production they have often suffered the consequences of policy and regulation made by those beyond the farm gate. It is therefore vital that the industry understands the issues, is proactive in learning what solutions are possible and is given the tools and the inspiration to find those solutions.



2.2. Objectives

Given all of the above, the objectives of my Nuffield Farming study are as follows:

- To investigate food waste on farm and the impact this has on growers and their businesses.
- To look at where innovative steps have been taken to reduce food waste and highlight some inspiring solutions.
- To assess the barriers to finding ways of reducing food waste on farm.

2.3. I would love to do it all but...

Within days of starting my research on this topic it became clear that my biggest challenge writing a Nuffield Farming report on the topic of food waste would be focusing the project. This was reaffirmed once I began my travels and talked to people from all walks of life about the topic. Firstly, food waste is a problem at each link in the food chain, from farmers to transporters to supermarket to households. Each link faces its own challenges in dealing with the problem. In addition, the extent of the waste differs for economic, social and cultural reasons and could be the topic of numerous theses. I therefore set the following parameters for my study:

- Given the breadth of the food waste problem across the various links in the chain it would be impossible to write about all of the issues. I therefore chose to focus specifically on food waste in primary production.
- Food waste occurs in all farming sectors but is particularly acute for fruit and vegetable crops. My study therefore concentrates on this sector.
- Food waste is a massive problem for developing countries and with future population growth expected to be greatest in these areas, investment in infrastructure and transportation will be vital [1]. Although there is no doubt that innovative solutions are being developed to combat losses in primary production in the developing world, the challenges facing farmers in these countries are quite different to those faced by farmers in the UK. My study and travels were therefore focused on food waste issues and solutions arising in the developed world.

2.4. My study tour

The UK is undoubtedly at the forefront of the food waste discussions and is one of the countries leading the way in finding solutions at most levels of the food chain. It was with this in mind that I



Figure 3 : FAO SAVE FOOD infographic 2012



chose the countries I would visit for my research. I wanted to see how farmers who faced similar problems to those in the UK were dealing with the issue and look at whether solutions found elsewhere could be replicated or provide food for thought for UK farmers. I therefore focused on activities in the EU and USA and built contacts and knowledge through attendance at various events including the Global Forum for Innovations in Agriculture (GFIA) in Abu Dhabi, United Arab Emirates.

Date	Country	Details
December 2013	Italy	UN Food and Agriculture Organisation (FAO), “SAVE FOOD” event. Meetings with UN officials, private and public organisations in the developed and developing world. Asked to speak on behalf of the European Farmers Organisation on ‘ <i>Over-production and Food Waste by Farmers</i> ’
February 2014	UK	Learn about the British experience from all players in the chain. Meetings with academics and activists on the issue. Increase understanding of the issues on farm.
April 2014 April 2015	Brussels	Understand latest EU thinking on food waste from a range of different sources. Attended conferences and European Parliament seminars on the top. Participated in Feeding the 5000 event. Visits to companies tackling food waste.
September- November 2014 January – March 2016	Ireland	Conferences on global food trends. Meetings with IFA, government, food companies and Irish Nuffield Farming Scholars. Farm visits to understand practical food waste problems and learn about experience of Irish farmers and the industry.
March 2015	United Arab Emirates	Global Forum for Innovations in Agriculture event looking at how we can use food waste to add value thereby delivering more sustainable food production. Meetings with experts on the issue including academics from Wageningen University, UN officials and international innovators.
April 2016	USA	Various meetings to look at the experience in the US of dealing with food waste. Visits to companies and restaurants. Experienced gleaning and practical farming solutions to the problem in New Jersey. Listened to opinions on what is hindering farmers themselves from finding solutions.



3. The problem

“Throwing away food is like stealing from the table of the poor and the hungry.” Pope Francis

3.1. Definition of food waste

Numerous definitions have been constructed by various organisations to define food waste. Academics, EU organisations, the FAO and others have all suggested ways to clarify and distinguish between the terms food waste and food loss, based on issues such as where the waste happens within the chain and whether or not the food is consumed by humans or used for other purposes. To date, there is no commonly accepted definition.

This issue was discussed at a breakout session at the Global Forum for Innovations in Agriculture (GFIA) in Abu Dhabi, led by Toine Timmermans, the Programme Manager of Sustainable Food Chains at Wageningen University. He concluded that *“in the EU we are trying to find definitions constantly and it is not working. It stops us getting on with dealing with the issue. We should not get obsessed with definitions.”*

To date, there is no commonly accepted definition (of food waste)

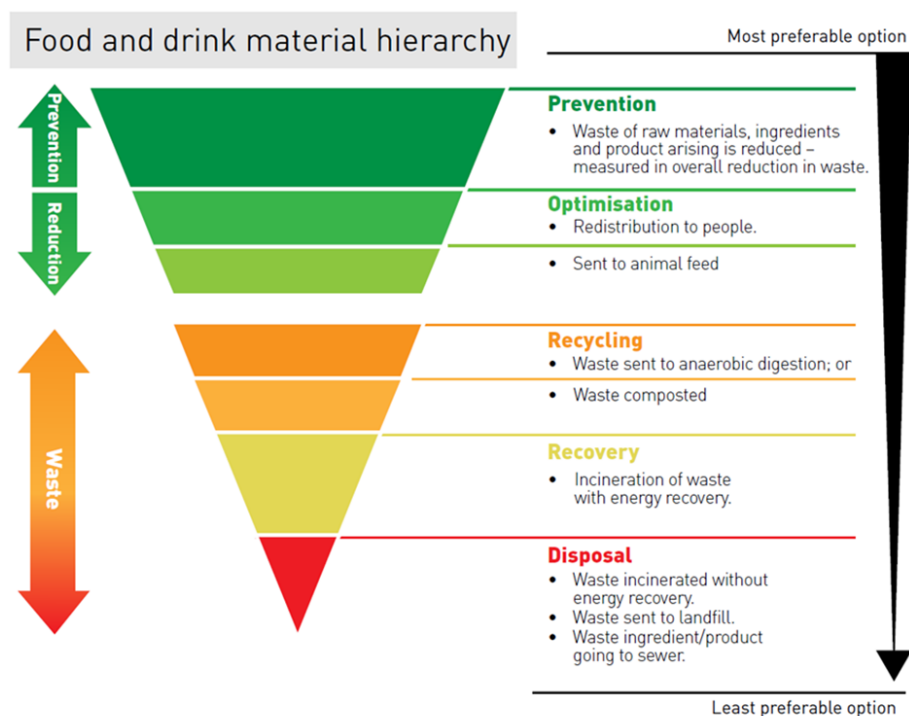


Figure 4 : WRAP food and drink waste hierarchy.

Although the terms “food waste” and “food loss” will be interchanged in this document, for the purposes of the report the recent definition from FUSIONS¹ will act as a guideline. It states that “Food

¹ FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) is a project about working towards a more resource efficient Europe by significantly reducing food waste



waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)” [2].

That is not to say that food waste used for animal feed or energy production, for example, does not have value. Indeed, these are massively favourable in comparison to disposal or landfill. However if food is grown for the purposes of feeding people it is my opinion that as far as possible, it should be used for that purpose. This was simplified during another discussion at the GFIA when a delegate from Jamaica told the group that criminals stealing harvested products from farms was the biggest source of food waste and loss in her country. Within the parameters of this study this is in fact not food waste or loss as long as those that stole the food ate it!

3.2. The environmental cost of food waste

According to the FAO, *“the environmental cost of food wastage is staggering which makes tackling it through specific actions an urgent priority” [3].*

The environmental impact of wasted food could be described as a ‘double whammy’ for the environment. At one end, scarce and precious resources such as water, nutrients, land and fuel are used to produce food. If this food is wasted, not only are we losing the food itself, but we are squandering the valuable resources used to create it.

The FAO has tried to illustrate the scale of the impact of food waste on the environment using a number of effective visual statistics [3].

- The total area globally used to grow food that ends up being wasted was about 1.4 billion hectares in 2007. This figure represents a land area larger than Canada or China.
- If the food that is produced annually but not eaten originated from a single country, that country would rank number three in the world for greenhouse gas emissions behind the USA and China.

Many commentators also highlight the impact that the growing demand for food has on world biodiversity. Dealing with world demand for food by minimising food waste would reduce the pressure to produce food in environmentally important and sensitive areas such as rainforests, wetlands and natural grasslands. [4]

3.3. Food waste in the UK

Described by a House of Lords report as a major public policy issue and requiring significant and urgent action, recognition of food waste as a significant social problem is growing in the UK [5]. Organisations such as the UK’s Waste and Resources Action Programme (WRAP) have actively driven measures to prevent and reduce food waste throughout the food supply chain. Evidence-based research, industry commitments and consumer campaigns such as Love Food Hate Waste have, in my opinion, placed the UK ahead of the curve in addressing the food waste issue. There is still however a long way to go, especially when according to the Love Food Hate Waste website, almost 50% of the total amount of food thrown away in the UK comes from our homes [6].



The amount of fruit and vegetable waste on farms in the UK is unknown. A lack of monitoring and data collection at this stage of the food chain significantly hinders attempts to accurately estimate the extent of the problem, a point acknowledged by WRAP. *“It should be borne in mind that monitoring food waste in primary production is a new area across the whole of the EU and WRAP will be working with key organisations in the sector to develop, by 2018, a more robust estimate of food waste at this stage of the supply chain”* [7]. However the National Farmers Union believes that *“While there are no accurate figures available on wastage in the supply chain, it is reasonable to predict that hundreds of thousands of tonnes of perfectly edible fruit and vegetables never reach the consumer”* [8].

Food waste on UK farms hit the headlines recently due to high profile campaigns by celebrity chefs supported by industry activists. Unnecessary aesthetic standards for fruit and vegetables imposed by those further up the chain are blamed for much of the waste and subsequent press on the topic is slowly but surely nudging supermarkets and consumers to consider the wider impacts of wasting food.

3.4. Food waste in the EU

Food waste is firmly on the policy agenda in the EU, and although attempts to address the issue have varied between the member states, the European institutions insist that the issue must be tackled to address wider EU objectives. As a means of achieving the 2030 Sustainable Development Goals, the EU has committed to the UN target of halving per capita food waste at the retail and consumer level, and reducing food losses along production and supply chains. To achieve this, the Commission is focusing on a number of measures including clarifying EU legislation that might lead to food waste and finding a common methodology to measure food waste throughout the EU. The European Parliament also produced its own report on the topic and designated 2014 as the ‘European year against food waste’.

The above EU measures are designed to complement but not replace solutions to food waste problems at a national level. Answers are being found at all levels of the chain in EU member states. Most recently, efforts in France have hit the headlines with the introduction of new legislation banning supermarkets from destroying or disposing of food and obliging them to donate or use it for animal feed. In Italy, legislation has also been developed that encourages food donations by making them more cost effective and reducing the barriers and bureaucracy associated with giving away food.

... it is estimated that the 28 (EU) member states produce about 100M tonnes of food waste every year and that 45% of this is generated by households.

In a recent report produced by the EU FUSIONS project, it is estimated that the 28 member states produce about 100M tonnes of food waste every year and that 45% of this is generated by households.



The accuracy of the information is determined by the availability of data from all member states at different stages of the chain. The document notes the lack of information was particularly acute for the primary production sector, and of the 28 members of the EU, only Denmark had data of sufficient quality on food waste at the production stage [9].

3.5. Food waste in the USA

... roughly 40% of the US food supply is never eaten, twice as much as in most other industrialised countries

In discussions on food waste, it is often mentioned that roughly 40% of US food supply is never eaten, twice as much as most other industrialised countries [10]. Recognition of the problem, especially the impact of this waste on the environment, is growing and in 2013 the USDA and EPA launched the U.S. Food Waste Challenge so that all participants in the food chain could share best practices on how to deal with the problem. In 2015, the government set a goal to reduce food waste by 50% by 2030.

There is growing recognition that food waste is a significant problem in the US and the recent economic crisis has helped move it up the political agenda. With comparatively high losses at the consumption or consumer stage of the chain, efforts are being focused on this level. However new and innovative measures are being tried and tested throughout the chain such as trayless dining in universities and schools, child and adult education measures and apps that link food businesses.

Like in other parts of the world, data limitations mean that it is difficult to estimate the extent of fruit and vegetable losses on US farms [11]. Feeding America however has estimated that more than 6 billion pounds of fresh produce go unharvested or unsold every year in the US [12].



Figure 5: National Geographic, March 2016 leads with a story on food waste



4. Food waste on farm

It is clear that the extent of the food waste problem differs at different stages of the chain. In general, household food waste has been the focus of much of the research on this topic and at the centre of many of the campaigns to tackle the problem. However, research and knowledge at farm level on fresh produce is lacking and the complexity of the problem along with the lack of data available on primary production losses have not been addressed with the same urgency.

Fresh produce food losses on farm occur for a number of reasons, some of which are outlined below.

4.1 Weather

The loss of perfectly good food as a result of severe or unusual weather conditions is an ongoing problem. Extraordinary large-scale weather events can obviously increase food losses significantly but many primary production losses are the result of localised weather patterns. One farmer I visited showed me hundreds of high quality cauliflowers that were not cut and were due to be ploughed back in. The warm Irish Autumn in 2015 played havoc with the production schedule. Planted for the Christmas market, the cauliflowers were ready too early and there was no demand for them.



Figure 6: Cauliflowers spoil in the field as they were ready too early for the Christmas market.



4.2. Produce rejected for cosmetic reasons

Demands by supermarkets and/or consumers for produce that reaches a certain weight, size and aesthetic standard contribute significantly to perfectly edible food being wasted. Entire crops or portions of crops can be wasted prior to harvest on the grounds of physical appearance [13]. In recent times these specifications have become tighter and more unrealistic leading to crops being destroyed or left unharvested in fields because they do not make the aesthetic grade. One grower reported that 25% of their apple crop was left unpicked in 2010 due to inadequate size [8]. It is estimated that up to 30% of the UK vegetable crop is never harvested as a result of these practices [13].

Aesthetic requirements are also set by government in an effort to differentiate between 'classes' of products. These regulatory measures have come under fire with opponents claiming that standards should only be set based on food safety concerns rather than quality issues and highlighting that the nutritional benefits of 'ugly' fruit and vegetables are the same as 'pretty' ones.

Cosmetic standards can result in the loss of large proportions of crops but are also the reason why significant parts of specific crops are also lost. On one farm I visited it was normal practice to trim celery of its outer layers, reducing the size of the crop to fit into standardised supermarket bags.

4.3. Forecasting

Despite best efforts to forecast future consumer demands, it is inherently difficult to always get it right. Estimating demand for fresh produce is very complex and is influenced by multiple factors, such as climate, season, specific marketing campaigns, new product launches, promotions, and holidays [14].

Farmers grow based on demand from those further up the chain and when this demand changes waste often occurs. Insufficient purchase forecasting, inappropriate ordering and planning and/or the cancelation of forecast orders can often leave farmers with an unsaleable product. The incorrect projections of demand for fruit and vegetables often result in merchandise not being sold before the expiration date and/or natural deterioration. In the absence of adequate secondary markets or the ability to find last minute buyers, food is often left in the fields or ploughed in.

4.4. Price

The market price for fruit and vegetables is undoubtedly a huge factor in terms of food waste on farm. Like in many businesses, farmers often weigh up the costs of bringing their produce to market based on the return that they are likely to see from that market. When market prices are very low, an economic decision needs to be made on whether it is more cost effective to harvest the crop and try to find an alternative market for it, or leave it in the fields. This was the experience of a number of producers I spoke with. Although they regretted the decision and hated to see their hard work go to waste, they felt that market forces gave them little other option.



4.5. Overproduction

The fear of not being able to completely fulfil retailer contracts can lead growers to produce more than the contract requires as insurance against unforeseeable problems and to avoid penalties. Agriculture representatives of all nationalities have highlighted the pressure farmers are under to ensure contracts are filled completely. As one tomato producer explained to me, *“If I fail to meet the order and supply the volume then the order is taken from me. This is critical for farming businesses, many of whom have invested heavily to enable them to produce the quantities necessary for these contracts. As such overproducing to avoid undersupplying supermarkets is standard practice in the agriculture sector”* [4].

4.6. Lack of storage facilities

Although an issue frequently quoted as a solution to the problem in developing countries, lack of adequate storage can also result in an increase in food losses in the developed world. Perishable products are vulnerable to temperature fluctuations and/or physical damage if not adequately stored. In addition *“A lack of effective storage frequently forces farmers to sell their produce as soon as it is harvested”* [13]. This is often at a time when many others are trying to sell the same crop resulting in a flooded market and decreased prices. A glut in the market can of course also lead buyers to demand stricter arbitrary aesthetic standards, thereby creating increased waste.

... lack of adequate storage can also result in an increase in food losses in the developed world.

... Improving storage facilities can lead to multiple benefits.

Improving storage facilities can lead to multiple benefits. For example, it extends the season of products allowing products stored to be released onto the market at a time when it is not in abundance. This can result in better prices for the farmer and reduce the waste caused by over supply at a specific time of year.

4.7. Limited secondary markets opportunities

Levels of on farm food waste increase if there is a lack of alternative markets for fresh produce that has been rejected by buyers or resulting from oversupply. Secondary markets can be a vital income source for producers that have already invested in a crop. However, the ability to access alternative markets can depend hugely on factors such as geography, infrastructure and cost effectiveness. The perishable nature of fresh produce is also often a limiting factor. Further processing is an important option for some, but many processors have advance contracts with suppliers or need produce with specific characteristics [12].



Figure 7 : Direct selling to the consumer through farmers' markets can be beneficial both economically and environmentally for farmers. Consumers at farmers' markets are often looking for a more genuine product where looks are not important

4.8. Lack of understanding and education on food production

The aim of most farmers and growers is to produce and provide the highest quality product possible for their customers. As mentioned above, quality is increasingly being associated with aesthetics and 'natural' shapes and sizes, although often equal in terms of taste, are seen as an inferior product. In addition, products that are mildly damaged are also often classed as inferior. Many in the supply chain recognise that these issues have little to do with real quality but they often see it as a risk to be associated with anything but top quality products. The consequences of this lack of understanding on quality trickles back down the chain to the farm and dictates what the farmer can sell and what is likely to be wasted.

4.9. Logistics

Often the key to ensuring that alternative markets for fruit and vegetables are found or mouths are fed is manageable logistics. Redirecting food can be a huge challenge especially for perishable fruit and vegetables. Avoiding spoilage is often only possible if efficient and timely measures are taken to redirect the food to its end user and if it is cost effective for the farmer to do so.

4.10. Labour

Food waste as a result of issues with on farm labour is emphasised in some literature from the USA, but wider political events do not preclude this becoming an issue in the UK also. Labour shortages have been highlighted as a major hurdle for fruit and vegetable growers leading to crops being left in the fields. One study highlighted that in the spring of 2011 there was a reported agriculture labour shortage of 11,000 in Georgia. The shortage coincided with harvest and led to huge losses of blackberries, blueberries, onions, watermelons, cucumbers, squash and bell peppers. It was estimated that the cost of these crop losses was in the region of \$140 million [12] [15].



5. Inspiring solutions

Making use of food that would otherwise be wasted is the focus of hundreds of initiatives at all levels of the food supply chain. These initiatives range from inexpensive simple solutions pursued by individuals to high tech intensive industry solutions.

At first, my aim was to focus specifically on the agricultural sector and the solutions being found on farm. Although some farmers are tackling the issue head on, my experience indicates that many are struggling to find ways and means of dealing with the problem. Pursuing secondary markets, feeding waste to animals and processing surplus produce are just some of the ways in which farmers are finding solutions. In this section, I want to highlight the most innovative and interesting of the projects that I witnessed and present this snapshot as food for thought for others to stimulate discussion and possibly action.

As I mention above, my main aim was to focus on solutions being found by farmers but it soon became clear that those farmers who knew and understood that food waste was an issue for those further up the chain were motivated to be more engaged with the issue. It is hoped that highlighting some of these inspiring examples will do the same for the reader.

5.1 New Jersey Farmers Against Hunger, New Jersey, USA

The organisation

Established in 1996, Farmers Against Hunger (FAH) grew out of the New Jersey Agricultural Society. It is a unique organisation inspired and instigated by farmers that want to see their surplus produce go to good use. FAH has been led by farmers since it was founded and they continue to serve on its board. They also play a pivotal role in organising gleaning events, outreach and fundraising.



Figure 8 One of the FAH trucks that transports gleaned produce to food banks and pantries.



The farmers that are involved and contribute actively to FAH own and run very different businesses. Some are huge producers that export throughout the US and beyond. Others have Pick Your Own farms that invite members and the public to come on farm to harvest their own produce when it is ready.

FAH actively campaigns for donations but is also funded through the application of grants from a range of local and regional sources. FAH has developed to support a staff of 6 and now has 3 vehicles on the road to transport surplus donated food and support volunteer gleaning events.

The inspiration

Although known as the “Garden State”, New Jersey has many urban areas that have been designated ‘promise zones’ to combat high levels of poverty. The FAH mission reflects this and aims *“to collect surplus fresh produce from New Jersey farms and deliver it to feeding organisations serving those in need”*. There are several reasons why the different farms I visited work so actively with FAH, ranging from loyalty to the New Jersey Agriculture Society, the drive to improve the image of farmers amongst the public, the need to reduce the costs of dealing with wasted produce, and personal or religious reasons. One of the farmers interviewed said she wanted local people involved in food and have sustainable community-focused farms. Another said he wanted to inspire others – *“farmers are not seen as extravagant wealthy people so maybe others will see them giving and give back too”*. Without exception, social concerns were cited by all of the farmers I interviewed.



Figure 9 Jim Giamarese, one of the founding members of FAH told me:

“It is difficult to see the produce going to waste especially with so many needy people on our doorstep. We started around the time that the state stopped a number of welfare payments. There was and still is a need.”

The product

FAH works in two ways. Firstly, farmers with surplus harvested produce contact the organisation giving details of the produce they have, and an idea of perishability. Where facilities are available, farmers may also store the produce for a period of time to increase the shelf life. FAH then try to ensure that the produce is picked up and distributed to food pantries, soup kitchens and events for people in need.



The organisation acts as an important middle man to ensure that the food is not wasted - farmers in the midst of growing and harvesting often do not have the time to transport produce and food banks and pantries do not have the vehicles or staff to collect produce at a moment's notice.

Secondly, and arguably the most important aspect of their work, is the gleaning programme. FAH has over 1,200 volunteers who give up their time and energy to harvest produce from fields that would otherwise go to waste. The volunteers work almost all year round; during the busy summer season right through to December when autumn crops such as cauliflower, potatoes and cabbage are still in the fields. A specific effort has been made to ensure that volunteers are from all sectors of society including local schools, youth groups and corporate groups.

The challenges

Consumer perceptions of quality

A farmer from one of the Pick Your Own farms I visited said that they often grow more than they think they will sell because their customers like to pick from plants bursting with vegetables. They said that bare plants where product is sparse leads to the impression amongst customers that the product is not of the highest quality. In addition, the farmer stated the following: *"Customers don't like to walk too far so lots of the produce in the bottom rows goes to FAH"*.

Storage

Effective gleaning programmes rely heavily on ensuring that products can be efficiently and effectively transported, and when that is not possible, storage is vital. Although still a challenge for FAH, the fact that the organisation is run by farmers is a huge benefit. With the active participation and support of farming members, FAH can more easily access farm infrastructure in times of need. For example, I was shown the Tri-County Cooperative Auction market, a site with cooling and storage facilities. The close links between those farmers that ran the market and FAH meant that gleaned produce could be stored and prevented from spoiling if there were delays or difficulties transporting the saved produce to its end user.

This was especially important for charities such as the Cathedral Kitchen in Camden, New Jersey. This charity feeds 350 people six nights per week. Quality is top of the priority list for all recipients of gleaned produce as the aim is to provide healthy balanced meals. Adequate storage facilities are often not available on site so the fact that product can be stored by FAH and its farmer donors is vital, especially in busy times and when faced with logistical challenges.

Funding

As mentioned above, FAH actively campaigns for donations but is also funded through the application of grants. As a relatively small organisation, the time and resources needed to continuously draw down funds is often a challenge. Writing funding applications can be demanding, requiring exhaustive detail and intensive effort. This can be a struggle with a small staff that is not always office-based. As Kristina Guttadora, FAH Executive Director, said: *"the bureaucracy involved in funding applications is often prohibitive for a small organisation like*



ours. We need the funds to maintain our activities but also to extend our reach to other areas. The funding is also often short term so this adds an element of uncertainty for our future work."



Figure 10 Cathedral Kitchen in Camden, New Jersey. The charity feeds 350 people six nights per week on food donations and aims to provide nutritious meals for those in need.

Donation or profit

The food banks continue to purchase fresh produce from farmers. FAH needs to be careful that their donations are not taking away purchases that could impact farm profitability.

Joined up action

There is increased recognition that food waste is a problem, but to ensure that time and resources are used as effectively as possible, it is important to avoid the duplication of efforts. After a farm tour with the Farm Bureau, participants not only recognised that food waste was an issue but also the importance of the work done by FAH to address the problem. As a result, FAH helped the Farm Bureau form three Bills which were signed into law in January 2016, ensuring recognition of food waste and gleaning as a priority issue. The legislation includes:

- Recognition of a state-wide gleaning week in September.
- Designation of an FAH day during the gleaning week in September.
- Promotion of FAH work on the Department of Agriculture website.

5.2. Baldor Specialty Foods, New York, USA

The organisation

From humble beginnings, Baldor Specialty Foods has grown to become one of the largest importers and distributors of fresh produce and specialty foods in the Northeast and Mid-Atlantic regions of the United States. The company traces its roots back to Balduccis, the iconic grocery store from New York City. Luis Balducci first peddled fresh fruit and vegetables in lower Manhattan back in 1916. The focus of the business was originally to distribute fresh produce but the company added speciality foods in



2008 to its list of products. This diversity in product offerings led many restaurant owners to their door and although today they have a wide customer base, food service is still at the heart of the business. As one Baldor staff member described, *“our heart and soul is food service. Restaurants come to Baldor for quality”*.

Baldor buys directly from farmers both in the US and abroad, but with an aim to supply the freshest food possible, the company’s policy is to encourage their customers to choose and buy from local farms. You can learn more about Baldor’s Local Pledge at <https://www.baldorfood.com/pledge>

The inspiration

The volume of food matter that Baldor was sending to landfill from its fresh cuts processing facility in the Bronx, New York, was increasing in parallel with its growth. It made good business sense therefore to investigate alternatives to landfill. Baldor began exploring options such as composting, anaerobic digestion and using what would be wasted food as feedstock for pigs. These options are still part of the strategy today but it became clear that they all had their limitations.



Figure 11: Some of the most popular items processed at Baldor's fresh cuts facility are carrot sticks, celery sticks, honeydew balls and diced onions.

The seed of a new idea was sown when a request came through from Dan Barber of the famous Blue Hill restaurant to use food scraps to create culinary delights. Blue Hill organised a three-week event in 2015 at their restaurant in Manhattan where the menu consisted only of food that would have otherwise been wasted. They sourced food scraps from Baldor to create dishes such as the *“dumpster dive salad”*. From this experience, Baldor recognised that they had an opportunity to help shape the market’s thinking about food waste and began to work to reduce food waste at their headquarters in New York. *“We had an epiphany”*, described Thomas McQuillan, Business Analyst at Baldor. *“Why are we treating some food matter as waste that is perfectly edible food? Food is never waste or garbage if the scraps or trim can be repurposed for human consumption.”*

The product

This led to an initiative called SparCs (“scraps” spelled backwards). In short, the idea was to use or repurpose any edible food matter generated in the Fresh Cuts facility as a result of processing, and



make new saleable products from food that would otherwise be wasted. This includes parts of the food such as cabbage cores, carrot peelings and celery butts. Thomas argues, “*Why don't we eat carrot peels? Isn't the nutrition in the peel?*”

40–50 types of fruits and vegetables are processed daily in the Baldor fresh cuts facility, creating hundreds of different products from carrot sticks to mango chunks, inevitably generating huge amounts of leftover food matter. These leftovers are the basis for SparCs.

At its core the SparCs initiative at Baldor aims to explore all the options to repurpose food that would otherwise be wasted, into a saleable food product. On a tour of the Bronx facility, Thomas pointed out a bin of onion peels. He explained that the machine slices the ends off onions but takes with it in the process edible outside layers. He is exploring options to sell these surplus onion layers and has had some interest from an Indian food company.

Baldor has partnered with other companies to promote their SparCs brand. For example, they are working with Misfit Juicery in Washington DC, a company that uses ‘misfit’ fruit and vegetables to produce cold pressed juices.



Figure 12: Baldor's Dried Vegetable Blend.

One of the most exciting products developed is the Dried Vegetable Blend. This is a blend of 15 different dried vegetables which are dried and milled at a local ingredients company. Baldor claims that there has been a lot of interest in the blend from chefs, given its taste and nutritional value, but is also hoping to sell it in the fresh food aisle in a US supermarket chain. McQuillan thinks that the vegetable blend “is a good option for us to divert a significant amount of food each week that then gets sent to a dryer and blended to make this exciting new product.”

The challenges

Making food waste a company-wide priority

In a company the size of Baldor, a significant challenge is getting buy-in from all levels of the organisation to put in the extra time and effort needed to repurpose food. Retraining and changing traditional practices is no small job for a company that employs over 1,300 people. Reducing food waste requires integrated activity and it can be difficult to convince people that



the extra measures required are a priority. As Thomas stated: *“There are champions in each sector of the company and these people are so important to make this initiative successful.”*

Experimenting can be risky

Experimenting with new lines of produce can be risky from a financial and food waste point of view. As one Baldor buyer explained to me, *“purchasing is a balance of art and science and it can be difficult to always get right”*. He described how the company had decided to take a chance on a new product recently in partnership with the grower. The product was not as popular as he had expected but both the grower and Baldor had committed to it. The priority for the company was of course to sell the product, but not allowing it to rot on their shelves was also a key concern. As a result, time and effort was dedicated to contacting customers and outlets to find new buyers for the product.

Buy-in from the rest of the food chain

Generating collective awareness of food waste and tackling it within the company has been a challenge for Baldor. However, there are also various obstacles to be overcome if it is to encourage its customers to engage with the campaign and embrace SparCs. Although some chefs are at the forefront of the fight against food waste, others have been more difficult to convince. Chefs need easy and consistent access to quality produce. They can be reluctant to take chances on ‘misfit’ products or take risks that they think might compromise the quality of their end product. Through this initiative, Baldor hopes to inspire its customers and others in the industry to reduce waste.

At the other end of the food chain, Baldor recognises that it has little influence over the food waste that occurs on farm. An example would be produce that is not harvested due to blemishes or size issues. Having a sustainable supply base is in the interests of Baldor and when surpluses occur on a farm, it is agreed that a financially viable solution needs to be found to improve the farmer’s bottom line. Although Baldor’s growers and shippers are separate business entities, there may be opportunities to work more closely with them to reduce food waste in the future. As Krista Call, Baldor’s Merchandising Manager, said: *“There may be opportunities to do more with our farmers who are willing to look at their production systems to gain efficiencies and reduce waste.”*

5.3 Blue Hill and Blue Hill Stone Barns, New York, USA

The organisation

The original Blue Hill restaurant is located in Greenwich Village, New York City. Opened in 2000, and described by the New York Times as *“one of the few New York restaurants that seems to get better and more original as time goes by”*, the restaurant prides itself on using local seasonal produce to create a farm-inspired cuisine. Dan and David Barber are co-owners of Blue Hill and Dan is the Executive Chef. Blue Hill’s success in Manhattan led to the opening in spring 2004 of a sister restaurant within the Stone Barns Center for Food and Agriculture in Pocantico Hills, New York. Located at the heart of a working farm, the Blue Hill at Stone Barns is the impressive center piece on a site where visitors can enjoy a lecture on the future of food, a homemade brownie in the cafe or a ramble down to the farm to see the birth of new lambs.



Figure 13: The Blue Hill cafe at the Stone Barns Center for Food and Agriculture

The inspiration

Although sustainability has always been a priority for the restaurant, Irene Hamburger, Vice President at Blue Hill, explained to me that the inspiration to reduce food waste was the result of a simple event. While at the farm, Dan Barber spotted a kale crop on its way to be composted. A massive hailstorm had left holes in the kale and it was beginning to wilt. Dan tasted the kale and realised that its quality had not been compromised. He decided to serve it and showcase it to his dinner guests despite its appearance. He named the dish ‘*hail kale*’.

The success of hail kale combined with Dan’s research for a book entitled *The Third Plate: Field Notes on the Future of Food* sparked a new idea at Blue Hill. The decision was made to contact every Blue Hill supplier and ask, “What do you have in your system that becomes waste?” Answers came from farmers, butchers, and cheese makers who responded “*almost with relief*” that the question had been asked. As food producers, the suppliers were eager to tackle their own food waste problems as it “*preyed on their minds*”. This resulted in instant connections and the decision was made to trial some new products from this ‘waste’.

The product

Using quality produce that would otherwise be wasted not only led to an array of new ingredients for the restaurants, but highlighted the value of the product amongst others in the chain. The next step therefore was to take the concept to the public, and to do this, Blue Hill in Greenwich Village temporarily reinvented itself as wastED, a pop up restaurant devoted to the theme of food waste and re-use.

The event ran for three weeks in March 2015 and brought together retailers, chefs, farmers, distributors, processors and producers with the aim of “*creating something delicious out of the ignored or un-coveted and inspiring new applications for the overlooked by-products of our food system*” [16]. Guests could choose from 19 dishes on the menu and a daily special conceived by visiting guest chefs from all over the country. Each dish cost \$15.

The kitchen then started preparing and exploring dishes for wastED and Irene explained a few of the dishes that made it onto the menu.



- The Dumpster Dive Salad – this dish used the ‘scraps’ generated at the fresh cuts facility at Baldor Speciality Foods, including lettuce cores and celery cores. The dressing was made from chickpea water that would otherwise be wasted, which was whipped with lemon juice and other ingredients into a foam.
- Dog Food – Dickson’s meat stand in Chelsea market, New York, is an old style, whole animal butcher. Although often full of flavour, offal is not a popular product with customers so is used to create dog food. Blue Hill used these cuts of meat and reinvented them to create their dog food meatloaf as a main course on the wastED menu.
- Juice Pulp Burger – the burger was created using the pulp left over from juice making. The bread for the burger was composed of stale leftovers and ‘repurposed’ into a bun.
- Pasta Trimmings – a dish using pasta trimmings made with a traditional old recipe was included on the menu. This oddly shaped pasta left over from hand rolling pasta is usually thrown away due to lack of demand.

The challenges

It must be delicious

Dishes made from ‘waste’ food can be a difficult concept to sell given some people’s perceptions of what should be sold at quality restaurants such as Blue Hill. The food must therefore be top quality and as delicious as other items on the menu. As Dan Barber explained to the media during wastED: *"If people left feeling like it wasn't delicious, then that was a failure. We had to feel like it tasted great."* The aim for Blue Hill is to have repurposed food of the highest quality as a permanent fixture on their menu. As Irene explained, the *"dumpster dive salad is now on the menu all year around"*.

Trial and error

Trying new ideas and exploring options to repurpose food that meets the quality standards of Blue Hill requires time and effort. Blue Hill continues to explore new ideas that taste great but minimise waste. Recently, they successfully designed a dish using the whole celery from root to tip. This involves cooking different bits of the celery in different ways to bring out the flavour and reassembling it in full on the plate. Other experiments have not been as successful. For example, Irene said that they were looking to create a dish from some of their cover crops on the Stone Barns farm. They tried a clover pesto, and although it did not make it onto the menu, it was a valuable experiment for the chefs.

Meeting demand

It is not good business to create demand for a product and not be able to support that demand going forward. Product consistency is also a priority. For example, instead of popular buffalo wings, Blue Hill was serving monkfish wings. Customers liked the new product but it became difficult not only to source it when needed, but to ensure that the size and weight were consistent.



Buy-in from the rest of the food chain

Without the buy-in from their suppliers and others throughout the food chain, wastED would not have been possible. However, this was not always easy and Adam Kaye, Vice President of Culinary Affairs at Blue Hill, was quoted in the press as saying that it *“took a lot of blood, sweat, and tears,”* to get it right.

When I questioned Blue Hill about the role of farmers in food waste discussions, they offered the following: *“our farmers are doing so much and it would be difficult to add to their already full plates”*. Irene added that the system needs to make it economically viable for farmers to make the necessary adjustments to deal with food waste. Just as the restaurant’s approach has influenced other members of the chain, she believes that it has also highlighted the food waste issue to their farmer suppliers.

Maintain motivation

Media attention has raised the profile of food waste and generated a drive amongst players in the food chain to act to tackle the issue. Blue Hill believes that we need to capitalise on this development and make the most of the opportunity to highlight the problem and solutions. Blue Hill has suggested that *“wastED created a family of people that responded to the challenge”* and remarked that it is important to maintain and build on that momentum to deliver real results.

5.4. Millibeter, Aartselaar, Belgium

The organisation

Established in November 2012 by Johan Jacobs, Millibeter is based in Aartselaar, Belgium. The company’s aim is to process organic waste into new commercially valuable raw materials and resources using the larvae of the Black Soldier Fly.

Millibeter is a start-up company and still in the research and development phase of its growth. Including Johan, Millibeter currently employs seven people. The company is funded by a combination of innovation grants from the Belgian Government, personal investment and bank loans. The current aim is to secure private investors and grow the company so that it can process waste and produce raw materials on a much larger scale.

The inspiration

Johan described how the idea started *“from the awareness that we have so much waste in our system but at the same time an unrelenting need for raw materials”*. The question therefore was *“how do we connect the two”*. Despite no background in science, he began to explore the possibility of breeding insects on a large scale. After trawling through scientific papers and investigating the business potential of a number of options, he decided to conduct some trials at home in his attic with the Black Soldier Fly.



Originally from the American tropics, the Black Soldier Fly is now prevalent in most (sub-) tropical zones around the world. The fly is well suited to breeding as it does not sting and only eats at the larval stage, so it does not spread disease. As it does not eat during the fly stage, it consumes and stores all of its energy at the larval stage resulting in plump larvae. This makes it an excellent bioconverter with a robust digestive system capable of processing a range of organic waste.



Figure 14: Larvae of the Black Soldier Fly.

After the initial trials, Johan was convinced that the insects could be the link between waste and resources. He decided to take a leap of faith, leave his job and set up Millibeter.

The product

The product is the larvae themselves. Fed on organic material – everything from manure to bananas, cauliflower to slaughterhouse waste - the fly only feeds during the larval stage and grows to a good size.

There are a number of products being trialled and tested at Millibeter and the company is currently exploring markets for all of these products

- Larvae bio fertiliser – a bio compost made from the frass of the fly larvae.
- Live larvae – live larvae are currently being tested with partners as feed for chickens and for fish farms.
- Dried larvae – whole larvae dried for the fish food and pet food industries.
- Millibeter has developed a means by which the larvae remains are broken down into their constituent parts;
 - Proteins - Approximately 40% of the dry matter of larvae is made up of protein. Once the legal framework is established, this high value protein could be used for animal



feed for chickens, pigs, cattle and fish. The larval meal can then be a substitute for fishmeal.

- Lipids - The aim is to use the lipids (up to 40% of the dry matter) from the broken down larvae in technical applications, such as cleaning products or soaps and lotions
- Chitin - Chitin is a high value product in itself for use in water treatment and the chemical and packaging industries, and can be processed further into different chitosan forms



Figure 15 Proteins, lipids and chitin developed from the larvae.

The challenges

The value of food waste

Currently, most of the food waste that Millibeter feed the larvae on is free. This may not be the case however as the company grows. In Belgium, organic waste cannot be landfilled so alternative means need to be found for those wanting to dispose of food waste. There is significant demand for this waste from the bio gas industry which pays the transport and delivery costs for the raw material. It could be advantageous for farmers with surplus produce if food waste were to have a market value, meaning that in the future Millibeter may have to compete with other industries and pay the market price for it. Although Johan argues that this is simply the market reality he has thought about getting the waste direct from source to bring down costs. This could include at the farm gate, with price determined by market forces.

Grey areas everywhere

As in many parts of the world, insect breeding is a relatively unexplored industry in Belgium. Lawyers and bureaucrats are often unsure how to interpret legislation and this can cause delays and frustration. It might therefore be a very long time before a number of the products that Millibeter is hoping to produce reach the market. Amongst other things, this has delayed the scaling-up of the business.

It's all about the money...

Funding is a challenge for any start up – investors want to see a product and an efficient means of production before they agree to invest. However, financial resources are needed initially to



achieve both of these things. Johan highlighted that the sustainability of the company makes it easier to get funding and support from government. The company is flowing with the political tide as it addresses reducing waste at one end and providing raw materials at the other. However, despite the rhetoric, private investors are not swayed as easily by the sustainability argument. As Johan puts it, *“they love to hear about sustainability but they are less inclined to pay for it!”*

The innovative need to innovate

Millibeter is working in a new, relatively unknown field. The nature of the business means that it requires partners that are willing to take risks and innovate. These partners are difficult to find. Johan explained how his approach to a well-known cleaning company brand was initially very positive and optimistic. They liked the innovation and sustainability credentials of Millibeter, especially its ethos on using food waste to produce a product rather than other unsustainable sources. However, the marketing department in the same company was less enthusiastic. It feared that customers would not react kindly to the idea that the fats used in their products were of animal origin. There was a particular concern that they would isolate vegan and vegetarian customers. It was finally decided that it was too much of a gamble to work with Millibeter.

As Johan pointed out, *“innovation needs to be an ethos throughout a company, if there is one broken link innovation simply does not happen. We are innovative but we need others to be innovative to buy our product”*.

5.5 Waste Taste Project, Copenhagen, Denmark

The organisation

The Waste Taste project was initiated by the University of Copenhagen Department of Food Science (FOOD) and is led by Associate Professor Karsten Olsen. The aim of the project is to develop, produce and optimise novel high quality food from food that would otherwise be wasted. This food waste is the result of overproduction or the requirement to reach high aesthetic standards.

Using a vacuum drying technique developed with one of the project partners, Wood Treatment Technology A/S, the project converts waste fruit, vegetables and berries into new food ingredients. The scientific expertise at the university is complemented by the work of the Nordic Centre for Local Foods (NCLF), an organisation which aims to develop new food products in a sustainable way and promote innovation. The NCLF is also FOOD's link to the farming community through their direct work with primary producers. Located in North West Zealand, the NCLF liaises with the local farming community to source the surplus produce used for the research, thereby ensuring that the novel food products are developed from an already existing food supply. Engaging farmers and ensuring they are proactively involved with developing this new market is important, so the NCLF also run farmer workshops to demonstrate how vacuum drying works in practice.

The project is funded by the Danish Ministry for Environment and Food.



The inspiration

John Greany Sorensen, a former researcher at the Department of Food Science, was working on his thesis to develop new chocolate flavours and textures. In a moment of frustration at his lack of progress, he aimlessly put some vegetables into a vacuum dryer. The result was surprising and a new idea was born.

Vacuum drying evaporates water from fruit and vegetables at a lower temperature, and according to FOOD: *“This results in great preservation of both the flavour compounds and the health beneficial substances in the raw product”*. As vacuum drying is a gentle process, it is therefore well suited to heat-sensitive foods like fruits and vegetables.

Sorensen’s accidental experiment resulted in the creation of vegetable crystals. The texture of the vegetables was now crisp and brittle, the colour brighter and the taste more intense. Sorensen had created something beautiful and new but also with massive potential. At a time when food waste was becoming a political and social priority in Denmark and when the media was full of stories about the need to reduce food waste and protect resources, it was decided that focus should be placed on the vacuum drying of food waste.

The product

Using the energy efficient vacuum drying technique, surplus vegetables, fruits and berries are converted into valuable food ingredients and new products. However, as researcher Sandra Stolzenbach Wæhrens emphasised, *“absolutely nothing is added, only water is removed”*.

Various novel food products are being explored:

- Crystals – juice from the food product is dried resulting in brightly coloured crystals with a light crisp texture. They have intense colours and flavours and can be made from vegetables such as beetroots and carrots.



Figure 16 – Food crystals created from vacuum dried vegetable juices.



- Drinks -The crystals are highly soluble and can be later used for juices by just re-adding water.
- Chips – slices of the food product can be vacuum dried, e.g. apple slices, and chip-like products can be created.

Not only does vacuum drying use products that would otherwise be discarded, it can create high quality products that open up new markets for the food industry. Currently, the aim is to demonstrate the application and potential of the product in partnership with others in the food chain, including:

- Restaurants and chefs – the high flavour intensity and appearance of the crystals are attractive to chefs for gastronomic reasons. They also add new and exciting textures to food.
- Health companies – given the high nutritional value, there has been interest in the product from a health and fitness point of view. The powders are also easy to transport for people on the move.
- Food production and processing companies – the attraction is that these are new, sustainable and natural food ingredients with a broad potential.

Minimising waste at primary production is a key driver for the Waste Taste project and working with farmer collectives is therefore vital to its overall success. Looking long-term, the project aims to upscale production to the point where farmers themselves can do the vacuum drying. This could therefore be another market for surplus produce and a viable economic option that replaces selling the produce at a lower price, using it for animal feed or incinerating it. As Sandra explained: *“for the farmer it effectively broadens the possibility of being able to sell the food as food”*.

The challenges

Location location location

At present, the vacuum dryer used in the project is located at FOOD for use by the researchers and scientists. If the aim of the project is to scale up and have farmers ‘own’ the initiative, it is imperative that drying their surplus product is not a hugely onerous task. The challenge is to bring the technique to the farm gate. Options are being considered such as a mobile unit that travels to farms in specific localities during specific seasons. Having drying ‘stations’ in strategic locations is also being considered but this raises other challenges such as transportation needs, new systems necessary to ‘book’ a station and what support is required and available at these stations.

Results of vacuum drying depends on the product

A range of chemical reactions occur when a product is dried as a result of the removal of water. How the specific piece of fruit or vegetable performs depends on a number of things including the sugar content. As a result, some products are well suited to the process. For example, beetroot creates bright vibrant crystals due to the high sucrose content, while products with high fructose levels such as apples are transformed into a brown colour and result in a less stable crystal. As Sandra explained, the process does not simply involve “pressing a button” and getting a final product that can be taken to market. Farmers need to



invest some time and effort in understanding how the process works and there needs to be value in the final product to make this time and effort worthwhile.

5.6 Wonky Veg, Co. Laois, Ireland

The organisation

Leo Dunne Ltd is a family business located in Durrow, Co. Laois, Ireland. The company has been in the vegetable business for generations but decided in the late 1970s to concentrate on carrot production. Supplying Dunnes Stores, Tesco, and a variety of small retailers, they grow conventional and organic carrots that are washed, graded and packed on site at their production facility. The carrots are harvested all year round and the company employs 30 people locally.

The nature of the vegetable business in Ireland means that growers need to focus on the consumer and adapt to survive in a challenging market. Leo Dunne Ltd therefore focuses on producing a quality, fresh product that tastes great.

The inspiration

The Dunne family has traditionally produced Grade 1 carrots of the highest quality. Inevitably, not every carrot grown makes this grade, and although alternative less lucrative markets were sought, most carrots of irregular shapes and sizes were wasted. As Emmet Dunne described to me *“For us and the staff it is disheartening to see your time and hard work go to waste. Not only is there long term economic value in dealing with the issue but it is the moral thing to do.”* Given that the quality of the carrot is exactly the same and that it costs the same to produce, it made good business sense to utilise this surplus product in the best possible way. The company therefore invested in processing carrots in-house and widened their product base into batons, diced and sliced carrots.



Figure 17 Carrots destined for the wonky bag

However, another idea for these ugly carrots began to take shape after a visit by Tesco buyers to the farm. Acknowledging the fact that the quality of the carrots is exactly the same, a decision was made to let the consumer decide if looks really are so important.



The product

Named "Wonky Veg", Tesco launched the product in Ireland in September 2014. Packed and marked clearly as "Wonky Veg", the project started with carrots and mushrooms, though Tesco explained to the media that *"There is scope for us to add more fruit and vegetables to this wonky veg line in the future but we will trial the offer first with carrots and mushrooms"*.



Figure 18 Wonky Veg ready for the supermarket shelves

The move to sell misshapen produce was welcomed by Irish growers and food experts who highlighted the waste that occurs on farms due to unnecessary aesthetic standards and false perceptions of quality. Allowing the consumer to actively choose wonky vegetables was seen as a step in the right direction by many stakeholders.

The challenges

Wonky is uncertain

The Dunnes have put years of experience and expertise into producing the perfect product and built a thriving business focused on the consumer. Retailers like Tesco pride themselves on meeting the needs and demands of the consumer at all times. If consumers want 'wonky veg' Tesco will aim to ensure that the product is always available to them. As a result of the standards of production at Leo Dunne Ltd the availability of wonky produce is often uncertain. As Emmet points out *"it is not that easy to grow a crooked carrot"*. It can therefore be difficult to always fulfil a wonky contract with a wonky product.

Survival of the fittest

As mentioned above, Leo Dunne Ltd has broadened its product base and processes carrots that do not achieve the necessary aesthetic standards into batons, diced and sliced products. Processing allows them the opportunity to use all of their valuable stock.

This has not been an easy or inexpensive endeavour and has required huge investment in machinery, management of standards and health and safety. The cost effectiveness of this investment is dependent on retaining the major contracts it holds with the leading



supermarket chains. When I asked Emmet if this kept him up at night, his response was that the Irish vegetable business is a tough industry, adding that “*we have no alternative; we couldn’t survive if we didn’t broaden our horizons*”.



Figure 19 Carrots to be processed into batons

Price

Price pressure is a reality for all Irish vegetable producers. The impact of consumer demands for cheaper food and fierce competition amongst the supermarkets is often felt most acutely by producers. The debate over what is a fair price for wonky products is a lively one. Some argue that as the product is nutritionally no different and costs the same to grow, the farmer should receive the same price for all of his output. Others argue that a lower price should be paid for wonky produce as it fails to meet certain aesthetic standards. The challenge therefore for Leo Dunne Ltd and others is to ensure that they get a fair price from those further up the chain and that any price differential is positively felt at the farm gate. It is also imperative that false perceptions of quality do not drag down the price that should be paid for top class carrots.



6. Discussion on barriers to finding food waste solutions

“Nobody said it was easy” - Coldplay

The inspiring solutions that I have documented in the report are just a tiny flavour of the food waste reduction activities that I learned about on my Nuffield Farming travels. Although very different businesses, there were a number of common challenges that emerged from discussions with those that I interviewed and met along the way. These are outlined below.

6.1. Time

I met with a tomato farmer who runs a lucrative stall in New York’s Union Square Farmers Market. Despite his very successful business, he said that waste tomatoes are a concern for him. He said that he already knew exactly what to do with them “I have the perfect recipe for the best tomato sauce”, adding that *“it will fly off the stall”*. When I asked why it wasn’t available yet he simply said he had *“not got the time, picking the tomatoes is busy enough and anything else during picking just doesn’t get done”*.

6.2. Money

Nobody likes to see waste, least of all farmers and growers who have put so much time, money and effort into producing their crops. This has inspired many to donate produce, facilitate gleaning and find other outlets for their produce that are more palatable than ploughing it in. But to really tackle the problem head on, there must be viable economic solutions.

Finding these solutions is the responsibility of the farmers and growers themselves, but given that the cause of so much waste is the result of demands from their customers, they must be supported in their efforts by others in the chain. Unexpected changes in demand from retailers and others, especially of perishable crops, can lead to huge amounts of waste and costs for the farmer. Developing a framework to share the risk between farmers and their customers is therefore vital. Better collaboration and engagement might also inspire new ideas on how to use the food.

There is also a role for policy in reducing financial risk. At the beginning of 2016, the US Congress passed a new piece of legislation extending tax incentives for food donated to charity, a move that was welcomed by many food stakeholders. Previously, this option was only available to bigger businesses and corporations but the new legislation extends the measure to farmers and others with the aim of reducing food waste and encouraging food donations [17]. Although the details are convoluted and complicated, it appears that some tax relief may be available to UK farmers for charitable donations. How attractive or feasible it is however requires more research.

6.3. Inspiration

I was struck by the view amongst some farmers that food waste was simply an inevitable consequence of the market. In particular, suppliers of supermarkets seemed to accept that this was normal practice and unavoidable. There is no doubt that the buying practices of big companies and indeed consumers



have a huge impact on the extent of waste on farm but farmers themselves cannot be complacent. As awareness of the issue grows and gains further social and political traction, the industry will be called on to take action. We need to shape that action but also educate ourselves and innovate to demonstrate we are playing our part.

It is difficult to find practical examples of measures to reduce food waste that are led by farmers or show farmers working successfully in partnership with others in the chain. Although the EU FUSIONS website includes a few farming case studies, I strongly believe that more needs to be done to provide inspiration to those who wish to take action.

6.4 Innovation

New ideas can inspire others in the chain to also start addressing food waste. Baldor Speciality Foods was originally inspired to address food waste as a result of a phone call from Blue Hill restaurant. This resulted in co-operation between the two companies but also stirred Baldor to act on its own to look at the issue in-house. Unfortunately, new ideas and products do not always inspire the same enthusiasm as documented by the experiences of Millibeter in the previous section.

If farmers are to be encouraged to innovate to reduce food waste then they need to know there is a potential market for new products. Support or willingness amongst those further up the chain to try and test new ways of working and ideas not only gives confidence but inspires people to be braver.

6.5. Data

Ultimately, food waste impacts on the farmer's bottom line. Finding a market for produce that would otherwise be wasted relies on consumers and others recognising that they can help solve the problem. This is difficult without clear information and data on how much food is actually wasted on farm. Although recent guidelines have been published recommending some methods for quantifying food waste at primary production [18], the nature of farming makes this a difficult task.

Based on the conversations I had with farmers, it was clear they would be nervous of the introduction of a requirement to collect information on food wasted on farm. Many talked about the extra bureaucracy, the difficulty in getting accurate information and commercial concerns on how that information might be used. However, I strongly believe that until we know the extent of the waste on farm it is difficult to motivate others to support efforts by our industry to address it.

6.6. Liability

Just like most mothers like to see an empty plate, most farmers would be happy to see their fields empty after harvest. Gleaning networks are popping up all around Europe aimed at saving food, promoting education, building awareness and donating to worthy causes. There is concern in some quarters that giving away produce for free can impact on market prices but the most significant concern for farmers is liability. Health and safety on farm is paramount and there is understandable nervousness amongst farmers to allow (sometimes) inexperienced strangers onto their fields.



Rather than creating obstacles, the legislative environment should empower farmers to innovate and try new things to prevent and reduce food waste. Policy on issues such as health and safety, environmental health and relationships within the food chain should enable rather than hinder farmers from playing a comprehensive role in finding solutions.

6.6. Customers

There is no doubt that many farmers feel that they have little control over the extent of food waste on farm. The requirements and specifications of their customers must be met and many believe food waste is an inevitable consequence of the actions of others within the chain. A number of supermarket chains in the UK, EU and USA have recently taken steps to sell more misshapen fruit and vegetables, but further action is required by all stakeholders. Some measures that would help farms limit food waste include developing forecasts and production programmes well in advance so that farmers can plan how much to plant, altering specifications to ensure produce can be sold if there have been weather or seasonal impacts and developing promotional campaigns at times of higher production.

Ultimately the key is better collaboration and ensuring that farmers are treated fairly and appropriately by those further up the chain.



Figure 20 The Grocer Magazine July 2016 leading with a story on wonky fruit and veg.



7. Conclusions and Recommendations

It goes without saying that preventing food waste should be our principal goal - it just makes sense! However, where this is not possible, my Nuffield Farming experience has led me to the following conclusions:

1. The food waste movement is engaging the public, policy makers and politicians. Farmers must be active partners using their skills and experience to find solutions, opportunities and shape outcomes.
2. Farmers need to see solutions as an opportunity. Solutions to reducing food waste at farm level do not have to be rocket science but they do require thought, investment, ingenuity and courage in various measures.
3. Co-operation is key. Farmers working together can help solve storage issues, logistical problems and make investments in infrastructure more worthwhile and profitable.
4. Co-operation is key. Solutions that involve various members of the food chain are most effective. However, activities by just one link in the chain can inspire others to act.

Recommendations

1. A 'space' highlighting successful food waste solutions at primary production level that is farmer friendly and includes practical information should be created at national and/or EU level.
2. The farming industry should be open to helping to ensure accurate data collection on food waste on farm. This may not be popular but it is necessary.
3. Government and others should aim to take the fear factor out of trying something new to address food waste by establishing a favourable legislative environment for farmers.
4. National and EU farming organisations have not always been an active partner in on-going projects. Farmers and their representatives should work towards repositioning themselves at the heart of food waste discussions.



8. After my study tour

Everyone has an opinion on food waste. My Nuffield Farming topic inspired so many random conversations - from the waiter in the European Parliament who caught me sneaking leftover peanuts from a reception to eat in the pub later, to the 8-year-old boy on my flight from New York who after noticing my reading material asked “*why do you like funny vegetables so much?*” This has been the joy of my Nuffield Farming study – getting out and about and speaking to people about food.

I hope to be able to contribute to future NFU policy on food waste but am also planning the following:

- The European Commission has launched a platform dedicated to food waste prevention and Copa, the European Farmers Organisation, is a member. It will meet for the first time in November 2016 and I am supporting the Copa political representative on the platform.
- Some of the contacts and friends I made in New York are looking into the possibility of replicating their activities in the EU. I am supporting them in their work and helping with contacts and connections in the UK.
- I have already spoken at some high profile events on food waste from a farming perspective, representing the views of primary producers. I learn new things constantly at these events – food waste is an extensive, developing topic that draws strong views and I enjoy the debate.

I feel very lucky to have been welcomed into the activities of both Nuffield Farming UK and Nuffield Farming Ireland during the period of my Scholarship. Over the past number of years I have presented to Scholars from both organisations on EU policy and major EU agricultural developments and hope to continue this in the future. I also now know first-hand how difficult and time consuming it can be to find and speak to the right people on very specific topics. I therefore intend to continue to help inform and facilitate meetings for other Nuffield Farming Scholars with relevant Brussels contacts.

My study is just the tip of the iceberg on this important topic and there are so many more questions to be answered. I have no doubt that there will be differing opinions on many of the issues I have discussed here but I am very grateful to have had this opportunity to contribute in a small way to the debate.



9. Executive Summary

Food waste is a global issue and widely recognised as having a negative impact on society, the economy, the environment, the climate and food security. It is also a moral concern that food is wasted to such a huge extent when so many, in both developed and developing countries, still go hungry.

My study and travels were focused on food waste issues and solutions arising in the developed world. I wanted to see how farmers who faced similar problems to those in the UK were dealing with the issue and look at whether solutions found elsewhere could provide food for thought for UK farmers. I therefore focused on activities in the EU and USA.

The objectives of my Nuffield Farming study were therefore:

- To investigate food waste on farm and the impact this has on growers and their businesses.
- To look at where innovative steps have been taken to reduce food waste and highlight some inspiring solutions.
- To assess the barriers to finding ways of reducing food waste on farm.

Reducing food waste is a 'movement'; some have even called it a revolution. Food waste is an issue that everyone can associate with and is engaging the public, policy makers and politicians. Previous experience indicates that where farmers have not been at the forefront of developments relating to food and its production they have often suffered the consequences of measures determined by those beyond the farm gate. Farmers should therefore be thoroughly engaged to shape solutions, opportunities and outcomes.

My research indicates that the most successful projects to reduce food waste are often those that are carried out in partnership with either other farmers or other members of the food chain. Cooperation is therefore vital. I also believe that farmers need to be more proactive and see solutions as an opportunity. Reducing food waste at farm level does not have to be rocket science but does require thought, investment, ingenuity and courage in various measures.

As projects and initiatives at national and EU level continue to develop and drive the debate, my report recommends that farmers and their representatives should reposition themselves at the heart of food waste discussions.

A farmer friendly 'space' that includes practical examples of success stories at primary production level should be developed as it would help inform and inspire others to engage with the issue.

Quantifying food waste on farm is an inherently difficult task. As such, I recommend that the industry should be open to taking measures to ensure data collection is as accurate as possible. Some of these measures may not be popular but they are necessary.

Lastly, Government and others should create a favourable legislative environment for farmers to prevent and reduce food waste and to innovate.

Maeve Whyte



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Clever policy, economic incentives, innovative thinking nor divine intervention could help me deal with the biggest challenge I would face reducing food waste in my own household!



Bibliography

- [1] Food and Agriculture Organization of the United Nations. (FAO), "Global Food losses and food waste.," Office of Knowledge Exchange of FAO, Rome, 2011.
- [2] <http://www.eu-fusions.org/index.php/about-food-waste/280-food-waste-definition>.
- [3] Food and Agriculture Organization of the United Nations (FAO), "Toolkit: Reducing the food wastage footprint," Office of Knowledge Exchange FAO , Rome, 2013.
- [4] T. Stuart, Waste: Uncovering the global food scandal, London: Penguin Books, 2009.
- [5] House of Lords Committee, "Counting the Cost of Food Waste: EU Food Waste Prevention," The Stationary Office Limited, London , 2014.
- [6] <http://www.lovefoodhatewaste.com/blog/2015/02/food-waste-facts-bigger-picture>.
- [7] WRAP, "Estimates of Food Surplus and Waste arising in the UK," WRAP, 2016.
- [8] NFU, "Catalyst for Change: Better ways of doing business in the Horticulture and Potatoes Sector," NFU, 2012.
- [9] FUSIONS, " Food Waste data set for EU-28 - New estimates and environmental impact," October 2015.
- [10] The Food Policy Research Center, University of Minnesota, "Food Loss and Waste in the US: The Science behind the supply chain," April 2014.
- [11] Jean C. Buzby, Hodan Farah Wells and Jeffrey Hyman "The Estimated amount, value, and calories of postharvest food losses at the retail and consumer levels in the United States," US Department of Agriculture, Economic Research Service, February 2014.
- [12] D. Gunders, "Wasted: How America is losing up to 40 percent of its food from farm to fork to landfill," Natural Resources Defense Council , August 2012.
- [13] T. Fox, "Global Food, Waste Not, Want Not.," Institution of Mechanical Engineers, London, January 2013.
- [14] NFU, "Food waste Briefing," October 2013.
- [15] John C. McKissick and Sharon P. Kane, "An Evaluation of Direct and Indirect Economic Losses Incurred by Georgia Fruit and Vegetable," University of Georgia Center for Agribusiness and Economic development, October 2011.
- [16] <http://www.wastedny.com/>.



- [17] http://healthyfoodbankhub.feedingamerica.org/wp-content/uploads/mp/files/tool_and_resources/files/feeding-america-2016-food-donation-tax-law-changes.pdf.
- [18] <http://www.eu-fusions.org/phocadownload/Publications/Food%20waste%20quantification%20manual%20to%20monitor%20food%20waste%20amounts%20and%20progression.pdf>.
- [19] Bond, M., Meacham, T., Bhunnoo, R. and Benton, T.G., "Food waste within global food system. A Global Food Security Report," 2013.