A Nuffield Farming Scholarships Trust Report

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Cultivating elders for the UK processing industries

Alice Jones

June 2020

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A Nuffield (UK) Farming Scholarships Trust Report

Date of report: (June/2020)

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

Title	Cultivating elders for the UK processing industries
Scholar	Alice Jones
Sponsor	Thatcher's Cider
Objectives of Study Tour	• Learn husbandry practices to cultivate elder as a productive crop plant. • Investigate suitable growing systems and setups for elder. • Understand how to encourage collaboration, knowledge sharing and support mechanisms associated with developing elder as a new crop.
Countries Visited	USA (Oklahoma, Missouri, Michigan, Vermont, Maine, Minnesota, Wisconsin) Canada (Quebec, Saskatchewan), Holland, Belgium, Germany, Austria, Slovenia, Romania, Poland, Portugal, UK.
Messages	• The UK native species of elder is a useful supplementary tree crop, from which flowers or berries can be obtained for a variety of applications • Understanding elder's botany is key to adapting conditions for success. • Several key management practices are essential for productivity and longevity. • Engaging in the whole chain or developing strong grower-processor partnerships is essential, since berries and flowers are ingredients requiring processing. • Globally, elder cultivation and the composition and functional properties of elderberries and, to a lesser extent, elderflowers is being researched and exploited, yet is understudied in the UK. • Countries successful in creating new elder product markets have done so through a collaborative approach between growers, processors and academics.

EXECUTIVE SUMMARY

Elder is a wide genus encompassing many edible species. In the UK, our native elder is Sambucus nigra. Elders are multi-ingredient-producing plants, increasingly being incorporated into farmed or managed systems, owing to the diverse and interesting sensory, chemical and potential health promoting properties of their flowers and berries, from which value-added products can be made.

It offers another layer of diversity to the farm and your diet, and a way of incorporating productive trees onto your land. This study shows the different ways elder can be managed on your land, from adding it as a secondary or tertiary crop alongside existing conventional fruit growing, reutilising the equipment and labour you have, to setting up lower input orchards, combining it with other crops in a mixed orchard or agroforestry system, to wild managing a patch on your land whilst enjoying its other ecological benefits and exploiting its beauty.

What started out as a very specific study aiming to learn how to cultivate elder for a flower crop resulted in the discovery that the opportunities with elder are much wider. Elder cultivation is very much under development around the world, although in areas such as the US, research in this area is already advanced. Contrastingly, there has been little investment in studying this area in the UK. During the study there was a realisation that the real key to knowing how to grow elder is not about following a prescribed list of treatments, but more about understanding the botany of the species, how it likes to interact with its local environment (above and below ground) and the fundamental principles behind how you work with it and your land to select or recreate optimal conditions. Deeper understanding provides a toolkit to apply to one's own land and operation and allows adaption of approach to ensure a long term, sustainable crop. To date knowledge exchange in this area in the UK has been largely unheard of, yet the value of collaborative working for growers and processors is highlighted as being key to the developmental success in other parts of the world and in creating support mechanisms that aid sustainable growth.

Whilst elder can be managed within conventional agricultural fruit orchards, an observation was made that many people involved in elder growing or research were often practitioners of agro-ecological and regenerative agricultural principles. It was concluded that this was no accident; elder's perennial status challenges the grower to longer term thinking. Once in the ground, crops of flower and or berries are taken from the same plant, year on year, for around 20 years (or even more), so preparing and maintaining the land and growing system to be rich in organic matter and promoting soil microbiology and health, wherever possible, appear to be helpful strategies to build resilience from the start and keep bought-in inputs minimal in the long run.

CONTENTS

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.

Please note that the content of this report is up to date and believed to be correct as at the date shown on the front cover.

Also note that full reference details are given on the last page of this report. Only abbreviated references are given in the main body of the document.

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1. Personal Introduction

I graduated from the University of Nottingham with a degree in Food Science, in 2004, and subsequently worked in a wide variety of technical roles in the food industry mainly in Small and Medium Enterprises (SMEs), operating at the premium end of the drinks industry, where sensory quality and distinctiveness are essential. I have worked closely with ingredient suppliers and growers, to ensure supplies of high quality, interesting and authentic produce can be sourced for food processors. I have been involved in many ingredient-led product development projects.

I care very much about food quality and integrity and believe that these attributes are best achieved when growers and processors get to know each other and work together. I am passionate about promoting the production of crops and developing finished products that genuinely taste good. I believe much of the food and farming industry has lost sight of this over the decades yet providing flavour and interesting sensory properties is ultimately the key to encouraging more consumers to eat a more varied and healthy diet.

Such values, originating from being brought up on home-grown and prepared food, were a foundation for specialising in flavour and sensory science. At the end of 2016, I returned to the University of Nottingham to work as Senior Food Innovation Advisor, supporting local Food and Drink SMEs with food science consultancy, and bespoke, business-led, applied research. Knowledge transfer is a key theme running through my career. I love mixing a scientific approach with the passion and character of small business.

I live in Melton Mowbray, a market town, in the Heart of England, with my partner, Adrian. Most of my spare time is spent working on my perennial garden or allotment and preserving and processing the produce which comes from that.

2. Background to my study

In 2006, I carried out a knowledge transfer project for one of the key processors of fresh elderflower in the UK, writing a Master's thesis about the links between elderflower processing conditions and flavour in drinks. I became captivated by people's love for this quintessentially British flavour. My career moved on, but I continued to collect information about elders and maintained links within the industry. People continued to contact me about elderflower, which developed into me offering specialist consultancy within this area. The nature of enquiries recently branched out from just product and process related questions to how to grow elder, and so this project came about.

Elderflower traditionally has been wild foraged and the industries using elderflowers in the UK rely largely on wild supplies. At start-up level this can offer sufficient volumes and often is well-managed from one's own land. Yet much of the industry has outgrown its cottage industry roots with elderflower products continuing to grow in popularity both nationally and internationally. British manufacturers have done a sterling job, creating products to authentic recipes and processes and have worked hard to build and grow export markets around the world. The wild sourcing model may be steeped in tradition, but as businesses grow larger, the competition for elderflower as a raw material grows. Sticking solely to wild sourcing means flower supplies inevitably come from increasingly further afield, bringing with it a number of uncertainties about sustainability, and security of supply. A wild harvest is unpredictable and must be collected from disparate locations. Bringing in the harvest relies on the motivation of the general public to go out to forage and the availability of flowers in appropriate, publicly accessible places. Importing wild-picked flower from other corners of Europe may be a short-medium term solution, yet the same uncertainties that we face with UK wild-picked now, will exist increasingly in those countries too. Regardless of the desired future provenance of elderflower the model will still, I believe, need to change. I embarked on this study because my links with growers and processors alike demonstrated there was an appetite for research, since similar questions have been raised multiple times, such as how to get commercial plantings established and how to maintain productive longevity. As an understudied, niche subject in the UK there are few resources and publications available for UK growers.

My project aimed to investigate how elders can be cultivated in the UK, both in a technical sense in terms of husbandry practices, and to study the options for production systems. I also wanted to study the mechanisms that could help develop and support an emerging farmed elder products industry.

3. My Study Tour

Country visited	I wanted to explore….
USA	• Elder as a new crop, growing practices and systems. • Research programs and collaborations. • Support associations and networks. • Development of wild native plants as crops. • Taxonomy of the Sambucus genus.
Canada	• Biggest elder farms in the world. • Whole chain operations.
Romania	• Other woody perennial flower crops • Biodynamic farming
Germany	• Long established, conventional farming of elder. • Nursery operations. • Varieties • Elder as tourism.
Austria	• A region famed for elderberry cultivation and processing. • Example of well-established elderberry cooperative. • Long established, conventional farming of elder. • Varieties.
Slovenia	• Research into breeding new elder varieties • Varieties in a botanical collection
Portugal	• Traditional elder growing practices and systems. • Grower-university collaboration to reinvent the elder industry. • Valorisation of elder products
Poland	• Traditional elder growing practices and systems. • Varieties.
Belgium	• Alternative ways of orcharding with niche fruit crops, including elder.
Holland	• A newly establishing elder farm • Understand start-up challenges.

4. Who grows elder and why?

4.1 Introduction to the plant

The genus Sambucus, to which elder belongs, is vast, including shrub and tree forms, edible and non-edible species. Elders tend to be woody perennials, although some forms appear more like herbaceous plants. Owing, most likely to its long-standing connection with man, and its main dispersal in the wild being by birds, elder is now found growing in much of the Northern Hemisphere (Bolli, 1994). Some subtropical species can also be found in some parts of the Southern Hemisphere (Personal Communication: Ivančič, 2019). Around the world, Sambucus nigra (the European elder) and Sambucus nigra subspecies canadensis (the American elder) are the most well-known of the edible forms, and these were the main species I saw on my travels. In general, each part of the world tends to use and grow the edible species native to their area: in Europe that's nigra, in much of the US and Canada, that's generally canadensis. There is some evidence of nigra being grown in northerly parts of the US and in Canada but the US and Canada also import and utilise nigra products.

Whilst widespread across the globe in the wild, I saw how some regions have been farming elder for centuries, whilst others are developing it as a new farmed crop.

4.2 Comparing and contrasting the global elder industry

Most countries have a specific focus on growing elder for either flower or berry. Elderberry is the most prevalent crop overall and the main reason why elder has established as a farmed crop in the first place. This is understandable from a financial point of view: one kilo of nigra flower becomes approximately seven kilos of berries (Personal communication: STBOG, 2019). Having said that, I did find examples of elderflower now being viewed as a new development opportunity, either in its own right or as a side line to berry, owing to a rise in consumer interest in flower products, as an opportunity to diversify a product range and differentiate oneself, and even in some areas, in response to having lost successive berry harvests.

My study was not intended to be an ethnographic, historical, product or marketplace analysis. However, a summary comparing and contrasting some of my key observations on these subjects, in relation to the elder growing regions I visited, can found in Appendix 1.

The main applications of elderflowers are in the form of consumer food and drink products, especially the drinks sectors and some goes into cosmetics. Elderflower was a farmed crop in Europe only in the cases where specific identity preserved status (such as organic or biodynamic), and a high level of traceability was valued by the buyer. Contrastingly, in the US, elderflower (all farmed) often commands a higher price than the berry.

I found it particularly interesting that an entirely new US elder industry had emerged essentially due to the concerted efforts of grower guilds, cooperatives and individual growers engaged in the whole chain, collaborating with local universities and each other, to create their own value-added marketplace. One of the original pioneers of commercial elderberry growing in the US, Terry Durham of Eridu Farms in Hartsburg, MO, with a background in organic vegetable growing, and founder of

the wholesale and consumer products brand River Hills Harvest (RHH) , explained this came about from a need for farmers to diversify their operations in response to a decline in the dairy and hay industries in the region, hence one of Terry's mantras: "Farmer grown, Farmer owned" which has been adopted by the Midwest Elderberry Cooperative (MEC), of which Terry is also a member and director, as a key objective to ensure this is a crop for which they will continue to receive a fair price. Growers sell as much as they can direct to consumers locally, receiving the best returns and further developing the market through direct engagement with consumers. If they don't want to direct sell or have spare crop, this is then sold to the coop.

Figure 1: A shot of RHH's Elderberry Juice: $3 in a café in the US. (Source: Author)

Figure 2: "Farmer grown farmer owned" appears on RHH product labels too. (Source: Author)

4.3 Elder as a secondary or tertiary crop

Elder was commonly grown as a secondary or tertiary crop as part of a diversified operation, for example, by fruit growers also growing cherry, aronia and apple in Western and Central European locations. In these regions elder was being produced in very conventional, intensively managed orchards. I also often saw elder grown in wine producing regions. The same attentive practices as used in a vineyard (such as regular pruning, mowing, keeping orchard humidity low) and sometimes even the same equipment was being reapplied to elderberry production, with success.

Figure 3- Elders grown amongst vineyards, Portugal (Source: Author).

Figure 4: Frank Gordon's farm in Missouri, with elder grown alongside Norton grapes. The elderberries are more profitable than the grapes (Source: Author)

Dan Moe of The Farm of Minnesota, MN showed me the organic elderberry that he grows in addition to organic black beans; he plans to expand his acreage of elderberry to meet demand for berry, selling it to the MEC he describes it as 'a cash crop'.

At Mud Lake Farm, Michigan, Kris and Steve Van Haitsma, have added elders alongside their hydroponically grown salad and herb operation, creating ingredients for their own added-value brand of “Farm crafted” cordials and sodas supplementing income from the salad. The farmers markets and high-end restaurants that they already sell salad into are also perfect sales outlets for their St. Steve’s drinks range. They are successfully utilising both elderflower and elderberries from the same elder plot, demonstrating how the crop can be split.

Figure 5: Ginger plants (top left, source: Author) and elders are grown alongside a main salad operation (bottom left, source: Author) to supplement income, by feeding into a “farm crafted” drinks range (right, source: Mud Lake Farm, LLC).

4.4 Elder as a maincrop

I did find examples of elder being grown as a main crop but usually the situation was one of either of the following:

1) The grower owned and operated the whole chain from growing to direct sales of consumer products, becoming an expert in both.
2) The grower had established a specific partnership with a consumer products manufacturer.

In Oklahoma, 360 Farms, is one such business engaged in the whole chain. Brent and Valerie Madding grow 7000 elders, drying the flower and berries in a purpose-built drying facility to make herbal teas/infusions and skin care products which they market under the Elderberry Apothecary Brand. They had to build up this repeat customer base in the early years going out to find the customer, for example at farmers markets, but now established, their customers come to them at their onsite shop (or buy direct online). Selling direct from farm is an efficient model and is

important to allow them to get to know their customer and the market well, ensuring their products are well targeted to market needs. They are also on the local agri-tourism route and I could see why people are intrigued to come and visit. Aside from the elder fields, they have aquaponic polytunnels heated by thermal mass storage (in the form of tanks of cull koi carp), where amongst other herbs, they also have an elder nursery operation. The ammonia excreted by the fish is converted by a bacterial inoculum into available nitrogen for the plants. They raised 8000 elder cuttings this year and sales of these make up 50% of their business now.

Figure 6: 360 Farms highlight the native status of their elders at the gate (Source: Author).

Figure 7: Valerie and Brent Madding work on all parts of the chain, at 360 Farms (Source: Author).

Figure 8: New elder cuttings being raised in 360 Farms (Source: Author).

Figure 9: Cuttings being grown on in polytunnels at 360 Farms.(Source: Author)

At Buehler Farms, a Missouri Century farm (one that has been in the same family for over 100 years or more) Kyler and Lynae showed me the first of the elderberries just ripening up and explained how they moved to the Ozarks to assist the Buehler family, who have transitioned the farm from a traditional dairying operation (also growing conventional crops like soy, wheat and corn) to be a

native American medicinal plant farm, with elder a signature product in their Elder Farms range. They make elderflower, berry and Cannabidiol (CBD) oil-based products for a wellness market, such as infused honeys and their signature HempBerry dietary supplement (see Figure 11), in the former dairy (now converted into a processing kitchen) and also retail direct to consumers online and through farmers markets. They also propagate and sell rooted elder cuttings to others as part of the business and offer a planting service for start-ups.

Figure 10: Kyler Brown, the author and Lynae Wright, with the first elderberries ripening up at Elder Farms, LLC. (Source: Author).

Figure 11: Some of Elder Farm's elder products made at the farm: (Source: Elder Farms, LLC).

One of Canada's biggest elder farms, Vitalité Sureau, shows how the vertically integrated business model of being the grower, processor and brand owner can work, whilst adding in extra elements, such as tourism. Most elder farms are aesthetically pleasing, particularly when in full bloom, but this elder operation had really made the most of that; a wooden cabin housing a bar and tasting room opens out onto a terrace overlooking their 20,000 elders (Figure 13). You can tour the fields or hold an event here. It felt like a high end winery, except what you buy (here or online) under the Purvita brand, is an elderberry concentrate for use as a dietary supplement, as well as a selection of elder-based soft drinks and food products such as jars of elder jellies.

Figure 12: The entrance of Vitalité Sureau welcomes passers-by to their Boutique and Bistro to try their elder products. (Source: Author)

Figure 13: The view of the elder fields from the terrace of the bistro and boutique at Vitalité Sureau. (Source: Author)

Figure 14: Some of the Purvita range of elderberry products made by Vitalité Sureau. (Source: Author)

I was fortunate enough to arrive at some of INS Farms elder fields in Missouri, to see the first day of their elderberry harvest. INS Farms reports to be the largest elderberry grower and supplier in Northern America growing 75,000 elders across the US. Their vertical integration approach means they have strong partnerships with the whole chain from growing, to processing, to supply of elder ingredients and isolates to other manufacturers including some of the most well-known American elderberry consumer product brands.

Figure 15: The first day of elderberry harvest at INS Farms. (Source: Author)

Figure 16: Elderberry harvesting at INS Farms. (Source: Author)

5. Production systems for elder

I saw elder being grown in a number of different systems, both higher and lower input, as well as some more novel applications.

5.1 Intensively managed, conventional orchards

The system I most commonly saw, particularly in Europe, was a conventional orchard, with regularly mown grass alleys and bare strips of soil under the tree rows, achieved with regular tilling (Figure 17) or by herbicide (Figure 18). Nigra is grown as free-standing trees and shrubs, without trellising or training. Canadensis is planted as free standing shrubs tending to quickly grow into continuous-looking hedgerows owing to their suckering nature (Figure 19). The completely weed-free and 'clean' nature of such an orchard is valued especially for berry production, keeping humidity low, in an attempt to deter pests such as Spotted Wing Drosophilia (SWD) and in some regions bare ground around the tree was favoured for rodent prevention.

Figure 17: Nigra 'Haschburg' selection in a German orchard, demonstrating the tilled area below the trees. Note, also, the size of the tree (for scale, author pictured is approximately 1.6M high). (Source: Author)

Figure 18: Herbicide strips, nigra – Austria. (Source: Author)

Figure 19: Typical format of a canadensis orchard. (Source: Author)

Orchards tended to be established using 1-year old, rooted elders, often grown as a monoculture of one particular selection proven by others in their region. Management of such orchards was highly mechanised except for regular hand pruning and harvest. Conventional mineral fertilisers were being used with multiple applications a year and up to 10 passes of an orchard a year to spray pesticides (both preventative and responsive). Whilst the input for an intensively managed elder orchard is probably still comparatively less than for other tree fruit crops, inputs using this style of growing were still quite high and notably were required throughout an orchard's lifetime. However, many using this model were utilising equipment, labour and supplies of fertilisers and chemicals used on the rest of their farm; this style of farming fitted their operation and knowledge base. I saw conventional orchards that were 20 – 40 years old and still productive in Europe. This model clearly can be successful.

5.2 Less intensively managed orchard systems

This was one of the most common formats I saw in the Midwest of the US and in Quebec, Canada for Canadensis. Elders are still planted in rows, but management is less intensive. Elders are often raised on farm in pots (or neighbouring local farms) from local selections. Organic fertilisation is common. I noted a strong focus on building up and maintaining soil organic matter content in these systems. Use of herbicides and insecticides were often very limited and used only as a line of last resort in response to detrimental infestations threatening severe crop losses (e.g. Japanese Beetle in the Midwest US or Spotted Wing Drosophila (SWD) in Europe). Sometimes methods used were influenced by the need for certified organic status; in other cases it was more of a choice based on the values of the grower turning away from conventional agricultural practices which had not benefitted them in the past. In many cases, notably, this was because growers had observed that there was enough resilience to survive local pest threats without significant economic damage.

Farming in a less intensive way, was accompanied by a number of regenerative practices. There is a high level of effort and investment in setting up to create optimal conditions, however, once established, as Ethan Foyt of Scarecrow Farms told me "Elders largely take care of themselves". After those early years, the interventions are only maintenance-based, such as maintaining organic matter levels, pruning and good weed control.

5.3 Elder in mixed systems

Elder is often incorporated into mixed orchards, for example inter-planted with longer term crops; you can gain some returns rapidly from the elder (for nigra, some flowers/berries in year one and up to full yielding in year three to four). In Portugal, I saw elder planted in between sweet chestnut (Figure 20), which can take 10-12 years to yield and whilst you can find whole orchards of elder, most have been planted to border vineyards and apple orchards (Figure 21), roads, driveways; every spare parcel of land has been utilised.

Figure 20: Nigra interplanted with sweet chestnut, Portugal (Source: Author).

Figure 21: Elders bordering apple orchards, Portugal. (Source: Author)

Csaba and Nimrod Szakacs, at Solarplant, a biodynamic botanical growing operation, in Romania, showed me how they were combining growing elder as a sacrificial crop within their fields of edible roses, protecting the flowers from aphid, rose chafer and apple blossom beetle. All will tend to

attack elder preferentially (the beetles are attracted to white flowers more than pink). In most seasons they did not appear to be losing much volume of their crop to insect damage, so they had plentiful supplies of high quality elderflower, with biodynamic credentials and assured traceability, to market alongside their cornflower, rose, calendula and chamomile flowers.

Figure 22: A row of elders every 4 rows of Rosa damascena, Solarplant Biodynamic Farm, Romania (Source: Author)

Figure 23: High yields of elderflower and Rosa damascena, growing side by side at Solarplant's mixed, biodynamically-managed farm, Romania (Source: Author)

In Gregg Forster's situation, in Wisconsin, it's his 4400 elders he is trying to protect, from Japanese beetle. I saw how damaging this could be to elders in much of the US but he has had success incorporating aronia into what he terms 'biobreaks' (although he credits the concept to Terry Durham of RHH); rows of alternate aronia, hazelnut, blackberry and wild plum that look rather like a hedgerow are included between every 5 rows of elder. Whilst he'd like to have some aronia to sell as well, the elderberry is the main focus for him. He shared with me an important point: if you are going to put elder in, you must plan to plant enough to warrant the delivery cost of the crop to the buyer or processing site.

A five-year demonstration trial (Figure 24) at Finca Mirasol, MN, has elders as part of a silvopastoral system, successfully growing alongside hazelnuts, in free-range chicken paddocks, rapidly creating shady spots to provide a cool, foraging environment. Both lead to beneficial effects on soil health. Chickens control insects naturally and there are plenty of free nutrients being distributed onto the ground from the manure. Tony Wells, showed me he is scaling up this concept and has started production at his nearby Regeneration Farms site where he is planting 6000-8000 elders in between hazel, through which he will rotationally graze 6000 Freedom Ranger chickens per season, producing slow grown, Tree-Range™ Chicken meat. They are already harvesting elderberries and will potentially harvest elderflowers and hazelnuts as extra crops too when they have scaled up primary processing operations. The elders are perfect for this application, due to their rapid growth, which quickly creates the shady patches they are looking for in brand new paddocks.

Figure 24: Hazel inter-planted with elder in chicken paddocks, Finca Mirasol, MN. (Source: Author)

Figure 25: Regeneration Farms have scaled up the farming of hazel with elder in their chicken paddocks (left, Source: Author), creating their own Tree-Range™ Chicken brand (right, source: Regeneration Farms, LLC).

Whilst elder can be grown in a conventional system, it lends itself and even thrives in mixed and agroforestry systems, particularly amongst other perennial tree crops.

5.4 Wild managing and low input systems

Self-described 'plant herder' (not ' breeder'), Ken Asmus of Oikos Tree Crops in Michigan, explained that to farm a wild plant you need to work with the plant to grow it in the setting that is most advantageous to its botany; that way you can reach a point where it is able to thrive with minimal input. Taking wild grapes: there are many varieties that have interesting flavours, but they fail every time when they are planted in a vineyard setting. Planted at the base of a tree to scramble up they are, however, very successful – this is their usual habitat, in the drip zone of a tree's canopy. Another example was native, wild Paw Paw; it suckers, growing in thickets within his food forest. He can harvest from this, thinning them out from time to time to ensure productivity remains high, but otherwise no other interventions are needed. This made me think of the frustrations that some have described, getting elder to establish back home, whilst watching wild elders flourish in nearby hedges. As we toured Ken's food forest he added another interesting thought: "Small, wild things taste so much better"; having tasted all manner of diverse plants that afternoon, including Ken's own wild blueberry jam, I can vouch for that. I noted on this visit how clever the food forest concept was; once established it is near to self-sustaining and it is ideal for producing, small, localised food supplies. I wondered whether this concept of managing a wild crop could be carried out on a larger scale.

In Maine, 485 farmers, wild-manage 38,000 acres of uplands stimulating a native, lowbush wild blueberry crop to emerge from the ground (Calderwood & Yarborough, 2020). I visited Beech Hill Preserve and learned about the high level of genetic diversity within the fields given the blueberries are not planted, rather managed to self-sustain. To obtain higher yields and ensure longevity, flail mowing or burning is carried out every other year. Some farmers manage more intensively than others, using herbicides to control weeds, whereas others weed manually or apply woodchip, ensuring a high organic matter layer on top of the soil, promoting ideal conditions for this shallow-rooted crop, that is otherwise exposed on very vulnerable sandy soil. I noted the synergies between

wild blueberry and elder in terms of the way that targeted management practices can be applied to help a wild crop perform in its own habitat.

Figure 26: The genetic diversity in Maine's wild managed blueberry fields leads to diversity in colour and flavour (Source: Author).

An example of wild-managed elders can be found in Michigan. Situated on ideal bottomland, the elders at Kris and Steve's Mud Lake Farm are in fact a wild-managed thicket (Figure 28). The main intervention is to keep the grass down, yet the yield and size of flower heads from a small area of land was impressive and more than enough to support their business. The growing conditions were very reminiscent of the ditch sides where you see elder in the wild in the US.

Figure 27: Steve and Kris Van Haitsma of Mud Lake Farm, MI, with their wild-managed elder (Source: Author).

Along the Mad River Valley, Vermont, elders have been planted into a riparian buffer zone to shore up riverbanks and minimise flooding in bordering villages, whilst providing a return to farmers (elderberries for local small businesses) who have given up 50ft strips of their land either side of the

river. Wild managing is the objective. Stan Ward, one of the project coordinators, showed me how they experimented with plantings low in the riparian zone (near the water's edge) and with farmland at the top of the riparian zone. Whilst ecologically speaking, those planted at the top of the zone, essentially on open farm land, could have delivered multiple benefits (protecting the river from run off from fields as well as erosion prevention and water retention) they did not survive well with little to no inputs, whilst the elders at the bottom of the riparian zone (Figure 28), were still there thriving seven years later, with zero input.

Figure 28: Lower riparian zone planting of elder self-sustaining, along Mad River Valley, VT (Source: Author).

The growing systems for successful elder production are diverse: elder can be managed in the wild or grown as a conventional tree crop. The choice of growing system tends to be influenced by factors such as:

i) the type and suitability of land you have available
ii) the existing equipment, labour resource, knowhow
iii) your business model – a main or supplementary crop?
iv) the values of the key marketplaces and the USPs they value

Regardless of whether farms were focussed on a flower or berry crop, and whether the crop is main or supplementary, since elder products are ingredients requiring rapid primary processing, farming operations were either networked into official cooperatives or unofficial networks, ensuring processing and storage were accounted for, otherwise they had their own equipment, or were in partnership with a processor.

6. Fundamentals for establishment, productivity and longevity

"Elder are extremely responsive to management" - Andrew Thomas, Research Assistant Professor at the Southwest Research Center, The University of Missouri.

Numerous texts refer to elder as 'growing anywhere'. Yet there is a difference between surviving and thriving (being productive) and whether nature chooses the habitat, or you do. When you do the planting, you are responsible for the habitat. Even if you want a lower input system, and you wish to use what you have already inhabiting your land, some management is required to ensure long term productivity.

6.1 Selecting and or creating the right habitat

The following are factors that are fundamental for selecting and preparing land for growing elder well:

1. **Full sun and sheltered spot** - Elders will grow in shade but they won't be as productive. Their wood is brittle and vulnerable to breakage by the wind.

2. **Well-drained land yet with regular access to water** - All growers emphasised this as important. Elder will not be successful in waterlogged land and it thrives where land is free-draining. If the roots sit in water, an anaerobic environment is created and the roots are starved of oxygen and will rot. Yet elders are not drought-tolerant either and you are unlikely to achieve maximal yields unless you ensure their water demand is met (for canadensis 2.5-5cm a week, especially during growing season and berry formation [Byers, 2019]). In warmer zones, I saw elder being irrigated, but in much of Western Europe there was no irrigation for mature orchards. In Britain it is advisable to plan to water in year one and two to ensure survival and good establishment, in the absence of regular rainfall.

3. **Know your soil type and condition, amending if not ideal -** Elders are a perennial crop; they will be productive for at least 10-15 years and so it is worthwhile knowing the status of your soil and spending time amending it before planting if you aren't starting with ideal conditions. The advice to test your soil and amend the pH to 5.5-6.5 was unanimous to ensure optimal nutrient availability. Soil structure and texture is equally important to ensure nutrient, water flow and absorption are optimal. Ensure the ground is not compacted; till 50cm-1M deep to aerate and loosen the soil before planting. Elder's roots are relatively shallow and need these conditions, especially during establishment.

   Most successful low input plots were located on bottom-land with fertile, black silt soils; in all cases these growers were obtaining good yields and regrowth without soil amendment. Elders also performed well on loams. There was a consensus that high clay content soil was unsuitable for elder due to a tendency to cause waterlogging in winter and baking solid in the summer (damaging shallow roots).

Figure 29: Highly sandy soil, without amendment, is as bad for elder as a high clay content. See the difference in performance in this field from the overly sandy area (left) versus a slightly more balanced soil (right) (Source: Author).

Amendment of soils was typically in autumn before planting to ensure an adequate phosphorus and potassium content, (especially when planting on previously arable land where such nutrients may have been depleted). Azomite and greensand were being used to enhance micronutrient content and improve soil condition. Cover crops including a 50:50 mix of grasses and legumes can be used to prepare the soil, and keep soil covered maintaining soil microbiological life between clearing and planting up the site, followed by mowing, or tilling them into the ground as a green manure, is useful for building organic matter.

4. **The higher the organic matter content, the better** - This was a key theme to success due to the positive effect it has on soil microbiology, physical structure, soil chemistry and therefore nutrient availability. Growers were achieving this by incorporating compost or rotted manures; advisable if you have 2% or less humus content (Schmitzer *et.al.,* 2017). This adds a carbon source to feed soil fungal mycorrhizae, encouraging the beneficial relationships needed with roots to ensure nutrients are in a form that can be absorbed. This is particularly important for elder which, as Terry Durham of RHH explained, doesn't have fine, hairy roots; the fungal mycorrhizae really help widen the uptake surface area. Anyone with a high organic matter soil, naturally or through amendment, reported good results in terms of establishment, plant resilience and yields. A study in the US has also shown that mycorrhizal networks establish faster with elder when compost is used in comparison to

adding commercial mycorrhizae products (Hanus, 2011). I also noted the use of horticultural charcoal or biochar to promote ideal conditions for mycorrhizae.

5. **Spacing –** The choice of spacing must ensure you avoid accidental damage to trees by machinery. Elder is unable to heal its bark if damaged. In the case of nigra, a free standing tree, there is a trade-off between maximising the crop you can access in the early years and planning for the spread of the tree when it reaches full yielding maturity in year 3-4. A common planting density for nigra in Europe was 500-600 trees/ha.

Figure 30: Nigra: branches which will eventually be 3-4 metres long, typically curving over at the tops; allow for a canopy spread of approximately 2 metres for flower crops (Source: Author).

Figure 31: Canadensis: well-spaced 3M apart to maximise sunlight and ensure air circulation for SWD prevention, at Les Sureaux Adams and Fils, Quebec, Canada (Source: Author).

6.2 Ongoing management practices

These are key to maintaining an optimal habitat for consistent yields and to promote the productive longevity of the trees:

1. **Weed control** - There was a consensus view that elders are greatly affected by competition, so weed management, especially in the first few years, is incredibly important. Where rodents were an issue, control was best achieved by maintaining a regularly tilled bare strip under the trees. Herbicide can be applied but elder is incredibly sensitive to many herbicides so efforts to ensure foliage and young wood are well shielded are important. John Hayden at the Farm Between, VT, showed me how he grows elder with a low input and no till approach, stressing to me the benefits of covering the ground, for example with a combination of landscape fabric and layers of softwood or fresh ramial woodchip, at the base of the trees. Using two strips of landscape fabric either side of the row allows compost additions at intervals underneath whilst suppressing weeds (Figure 32). The woodchips cover the gap. Several growers were even growing their own soft woods such as basket willow and alder to chip themselves. Wood chip also retains moisture and prevents soil erosion - both beneficial to elder and soil health alike.

Figure 32: Use of landscape fabric for weed suppression at The Farm Between, VT (Source: Author).

Figure 33: Planting though holes in black plastic at Scarecrow Farm, ME, retains moisture and suppresses weeds, which is essential in establishing years (Source: Author).

Figure 34: Rotting woodchip an ideal mulch for elders (Source: Author).

2. **Nutrient management -** Optimal fertilisation programmes were still in development for elder but depend hugely on the state of the soil at the start. Building and maintaining soil organic matter was even more important than adding a mineral fertiliser. If the structure and microbiology are not optimal, the roots may still not have the right conditions for uptake despite what you apply. Elder are high feeders and growers linked nitrogen applications to maximising yield. In established European orchards decisions to apply nitrogen were based on assessment of yields and the degree of new growth in response to pruning. In some years, there was no nitrogen application. It's a balance between ensuring there is enough energy to produce new growth for subsequent seasons, but without creating excess foliage. The amount and methods of nitrogen application varied greatly amongst growers.

   Michele Warmund, Professor of Plant Sciences at The University of Missouri pointed out that a gradual approach of experimenting with small incremental nitrogen applications with observations of yield is a smart approach to finding out the lowest quantity that will produce the yield you need. Dried chicken manure, rotted farmyard manure and also inorganic fertilisers such as calcium ammonium nitrate were all being used. Most who apply nitrogen in a readily available format did so in small amounts spread out over a number months in the growing season, from budbreak (addition of nitrogen at this time is especially important following winter pruning to give energy for growth in the spring), up until flowering and then again after flowering with the objective of promoting growth for next year's season before the plant then goes dormant. Nitrogen requirement trials to determine an optimal nitrogen level for Canadensis are currently underway at The University of Missouri but have not yet concluded. In the meantime, extension services are recommending that Canadensis growers use at least 67kg N/ha, applied in stages throughout the growing season. This figure is based on the known requirements for blackberry (Byers, 2019).

When solid organic fertilisation is being used, this is a slower release method, and is often applied in dormancy allowing time for mineralisation for spring regrowth. Using this fertilisation technique benefits the soil structure, condition and microbiology. Where growers had irrigation lines in place, in drier zones, nitrogen application was in the form of fertigation. A number of growers were growing cover crops in between elder rows to fix nitrogen giving the added benefits of gaining extra organic matter with the covered ground also preventing moisture loss.

Whilst development of nutrient management guidelines will be helpful for growing elders, I did become aware of the complexity of the subject. Too much nutrient could be as negative as a deficiency and simple addition of mineral fertilisers may feed the plant but does not feed and build the soil long term. Tony di Maggio at Sacred Blossom Farm, WI, growing a range of herbs, for high-end herbal teas, actually favours no irrigation and no added nitrogen (other than naturally produced from cover crops). He explained, he is in the business of creating potent flavours and not huge amounts of biomass. When I visited Professor Silvia Roca at the University of Aveiro, I understood the links that can exist between environmental stressors and secondary metabolite production and the fact that it's often the secondary metabolites, produced by the elder to protect itself from damage (such as animal grazing or UV light) or stress, that are the very flavours, colours and phenolics that make elder products tasty and beneficial to the human body. When it comes to producing an elderflower crop, there is a need for sufficient nutrient to replace biomass reduced in pruning, yet the ultimate objective is to produce flowers rich in essential oil.

Elder nutrition is a subject in development but for sure requires some thought beyond just producing biomass.

3. Pruning

"Pruning is the most important thing. If you don't cut the tree, forget the tree. The most Important thing is to think of the future" **– Bruno Cardoso, Inovterra, Portugal.**

Pruning is key for productivity, consistency of yield each year and continued productive longevity. Elder is quick to grow, yet quick to senesce. The act of pruning literally keeps the tree alive, encouraging it to constantly regenerate. Stop pruning and you will lose this perpetuation of the crop year on year.

Pruning starts at time of planting and is continued, annually throughout life. Canadensis, in warmer zones from the Midwest of the US and further south, is cut entirely to the ground during dormancy, often mechanically. In more northerly zones the growing season is not long enough to support regrowth with flower and berry production, so selective pruning by hand or by mechanical pruning, leaving wood above ground is practiced. This is associated with consistent yields and production of larger flower/berry heads (more efficient to pick) and is possible due to the fact canadensis flowers on the end of 1 year old branches. Annual cutting to the ground is also beneficial to avoid pests overwintering.

Nigra, on the other hand flowers mainly on two-year wood. Thus, annual cutting to the ground is not advisable, other than for regeneration of an ancient specimen (and don't expect a crop next

season). Wood older than two years is capable of flowering but the flower heads and berries are likely to be smaller in future years and you risk allowing the entire structure of the tree to begin dying back, putting both productivity and longevity at risk. Branches that have flowered/fruited already are cut, leaving 8-12 branches of mixed one- and two-year- old wood while keeping an open structure. The prune back point is either from a central trunk or to the ground. Your orchard management methods and whether you grow for flower or berry will both influence the location of the prune back point.

With nigra, selective, hand pruning is applied during dormancy:

- On planting a new whip – cut all branches back two nodes from the end of branch.
- Annually thereafter – the aim is a balance between stimulating enough regrowth for subsequent years and having enough current productive wood.

Figure 35: Freshly pruned nigra, pruned to a central trunk, Portugal. (Source: Author).

Figure 36: Nigra pruned back to the ground, in Poland. (Source: Author).

6.3 Growing on challenging land

Suspecting elder might be an unlikely maincrop for many in the UK, I visited growers succeeding with utilising non-ideal land.

In Poland, Frank Kasprzak utilises pieces of land for elder growing that were difficult shapes to access with machinery and thus regarded not suitable for arable crops. These pockets of land were often wedged between bits of woodland, yet he pointed out to me that elder really thrived here (Figure 37 and 38). This was a trend that later Ethan Foyt in Maine and Has Van Helvoort of De Vlierderij, in Holland also showed me. The importance of fungal mycorrhizal interactions with elder roots, which are expected to be better developed near other trees, combined with the creation of shelter, I believe may both help explain this.

Figures 37 and 38: Sheltered pockets near woodland seemed ideal for elders. (Source: Author)

Spare land on a farm may also be marginal and or poorly drained or have an extreme soil type, unfavourable for elder. At East Hill Tree Farm, VT, Nicko Rubin showed me how his elders grow better on his land on berms, which are mounds about two feet high consisting of topsoil piled onto branches and twigs and covered in organic matter mulches such as softwood chip.

Nicko links the success of using berms for elder to better drainage, equally noting that he hasn't needed to water, as the mounds hold moisture well. By building upwards, soil conditions for elder can be made ideal from the start rather than trying to dig out and amend the land below. Being shallow-rooted, this is sufficient for elder's root system. The use of small, twiggy prunings (and woodchips made from them, as mulch) means the berms are particularly rich in organic matter and nutrients. Digging into the berm, Nicko showed me white fungal growth, a good sign that the right type of mycorrhizal fungi will be present.

John Hayden, at The Farm Between, VT, explained this method is called Hügelkultur: any woody matter and organic biomass can be added to the pile, the rotting woody parts acting as a sponge retaining moisture. There is also the ecological benefit of meaning that the carbon locked up in prunings is held, as much as possible, buried into the mounds rather than being burnt which would release most of the carbon to the atmosphere.

Figure 39: Mature elder planted on a berm. (Source: Author)

Figure 40: Mini berm used for establishing cuttings. (Source: Author)

Figure 41: The white fungal growths indicate the right kind of mycorrhizae for elder are present (Source: Author).

Amending soil in a field to achieve optimal conditions for elder may seem unfeasible; building a berm on top of poorer land seems like a more achievable solution and organic debris from other parts of the farm can be re-utilised.

6.4 Propagation and establishment

"The first few years are about roots, roots, roots"- Ethan Foyt.

Figure 42: Ethan Foyt at Scarecrow Farm, ME (Source: Author).

Elders are propagated from soft or hardwood cuttings. Hardwood cuttings are particularly easy to root with many growers putting wood directly into the final growing position in autumn. Soft wood cuttings, whilst not as commonly used, have the advantage of being lower risk in terms of accidental spread of pests or disease more likely to be harboured in older wood. In colder regions, many were raising cuttings with one to two nodes above ground and one below, in pots and under cover, planting out to the field after 1-2 years. In Portugal, Bruno Cardoso of Inovterra, showed me how taking 1 metre lengths of nigra wood and direct planting to the field, resulted in a shorter timeline to

produce a mature tree. Pruning was conducted in autumn and early winter, so the prunings can be put straight into the ground to create the next generation of stock.

Figure 43: Bruno Cardoso of Inovterra, Portugal, demonstrating how prunings are reutilised as cuttings (Source: Author).

One of the most common mantras I heard on my journey and which can be found in many texts about growing elder, (for example Moody, 2019), is that elder “sleeps, creeps, then leaps”. It is so pertinent. Root development is the reason for minimal aboveground growth in year one. Actions that help to introduce and maintain a strong mycorrhizal network in the soil are extremely important for establishment, alongside consistent irrigation. Remove flowers, even if ultimately you want to create a berry crop; use the energy to produce roots. In years two to three you should see the creep stage in the form of production of many branches and their rapid extension. From here, the objective with nigra, is to grow long branches with lots of nodes, as this is where flowers emerge from. By year three to four you should be reaching full maturity and yielding. The focus then switches to maintenance practices. At the Veteran’s Farm Initiative in Minnesota, Charreise Norris, summed this all up, likening the establishment of elders to raising children explaining it as, “Lots of work in the early years, less so later on”.

6.5 Threats from pest and disease

As with any crop there are pests and diseases that can threaten elder. In the EU, berry growers increasingly have issues with SWD. In recent years this has caused significant losses to the EU elderberry crop. Historically, Tomato Ring Spot Virus was a huge problem in New York State (Way, 1981) and new emerging viruses are being studied in the US. Rodents can destroy roots and the base of trees, deer enjoy browsing elder and birds can be an issue with a berry crop. John Hayden at The Farm Between, with a background in entomology, showed me how insect pest levels are manageable at his tree farm and nursery without the use of insecticides, through having a high diversity of crop species, planting in polyculture, incorporating plants that are favoured by predators and through not totally eliminating every single pest thus allowing the predator populations to remain present (Figure 44). John doesn't remove all the wild parsnip that appears on his land, as this provides nectar for a parasitoid fly (Tachinid spp.) that kills Japanese beetle [Hayden & Hayden, 2019]. I saw the economic damage Japanese beetle can do to a US elder orchard during my trip, so strategies such as this are vital.

Figure 44: Left- wild parsnip; Right - the white spot seen on the thorax of a Japanese beetle are the eggs of a parasitoid fly – the emerging maggot will kill the host (Source: Author).

Aphids and SWD are risks to consider in the UK. I became very aware of the value and importance of methods of prevention and good hygiene when setting up nursery operations to sell to others or when creating your own stock from cuttings or sourcing stock. The potential for viruses and pests to be transmitted via cutting wood is significant. Undoubtedly the development of a new elder growing industry will need to be accompanied by research into how to manage pest and disease. Achieving ideal growing conditions is also important; a resilient plant that is well established will hold up better in response to pest attack.

6.6 Varieties

I saw numerous selections of nigra and canadensis being grown commercially. There are notable differences in sensory properties between the canadensis and nigra flowers and berries. Berry anthocyanin profiles also differ. Neither one or the other can be described as better, rather it's

important to understand which profile a specific marketplace expects and it depends what type of product you are making as to which one is chemically and sensorially most relevant. Named cultivars in commercial production are a result of selections from the wild for favourable characteristics such as large head size, vigour, tree/bush shape (and thus suitability for different sites or environments). Since berry is the most used crop globally and tending to come from farmed sources, most selections have been made with a high quality and yield of berry in mind but also for more specific traits (e.g. in canadensis there are selections for bird damage prevention, where elderberry heads are held downwards rather than upwards). Whilst a high yield of berries can be associated with a high fresh weight yield of flowers, I did not find selections have previously been made with flower quality in mind.

Globally, cultivars appeared to be region-specific. Many people along my journey recommended planting a mixture of varieties for the following reasons:

- **Determine how a cultivar's individual traits interact with the local environment**. Using named selections gives you an element of certainty about what characteristics you might be able to expect given that someone chose it for a specific beneficial reason but you need to take into account suitability of the selection for the local environment.
- **Increase resilience to different emerging pests and changing climate**. Some cultivars are likely more resistant to some threats or environmental challenges than others.
- **For better yields of berries**. Whilst most cultivars in both subspecies are at least partially self-fertile, individual berry size has been shown to be bigger where different cultivars are able to cross pollinate.
- **Control the timing and length of the harvesting seasons**. Flowering occurs over a matter of 2-3 weeks in nigra (season extension is best achieved through planting in a variety of different geographical areas and is most extended by planting at varying altitudes [Senica et.al., 2016]) but can be wider in canadensis cultivars as some are determinate and some are indeterminate.

I found just one example of current elder breeding research. Professor Anton Ivančič at the University of Maribor, Slovenia has worked on this area for the last 20 years, travelling the world and studying the different traits across the Sambucus genus. His work to date does show great potential to create commercial cultivars through cross breeding, by exploiting the diversity of morphologies from within the wider Sambucus genus, to find solutions to the various difficulties in cross breeding has presented and to address the challenges to commercial elder growing (for example: vole resistant roots, aphid resistance, forms and growth habits for mechanical harvest and flavour improvement of berries).

Ken Asmus, of Oikos Food Crops, contrasting his diverse thirteen-acre food forest with the monoculture Concord grapes destined for juice-concentrate in the field next door, warned me, "Cultivars have a start and end date,"- meaning they are really successful for a snapshot in time and then the climate changes or a new pest moves in and suddenly they don't possess the genes to deal with that; a sobering thought which highlights how continuous work on new varieties is required. It was here that I also appreciated that just as we seek to increase the diversity in the number of species that we eat, diversity within an individual species is required for ongoing resilience of a crop plant. Ken achieves this by raising populations from seed and holding repositories of wild relatives

to crops. He believes every farm should be raising its own population of new diverse material for the future, providing an even more resilient genetic bank than one repository in one geographical location can provide. Keeping the repository in near organic conditions, means the plants you select are already resilient to pests and disease.

7. Support mechanisms for developing elder as a crop plant

"You need an elderberry champion" - Terry Durham.

Figure 45: Terry Durham (right) and Cody Struckhoff of RHH, with an elderberry destemming device designed by Terry (Source: Author).

7.1 Networks and knowledge exchange

Attending RHH's, Elderberry Grower's Workshop in Missouri in June 2019, with circa 100 growers I was impressed by how this event acts as a forum for advancing knowledge and is linked in with those doing research. It has been running since the late 1990's. It went beyond an education event; it was about empowerment and confidence building for existing growers and a way of encouraging new growers. It combined a mixture of grower and academic presentations combining scientific studies with grower trials and observations. It was clear that many growers come back year on year for continued learning and interaction. There was a sense of camaraderie and community. I could see how that had built both strong relationships and trust, which had translated into a practical support network being formed for those experimenting with and developing the farming, processing and marketing side of their operations. There were social media knowledge sharing groups who stay in touch for the rest of the year and countless regional grower groups have established themselves, perpetuating the learning and to share equipment and ideas at a local level.

The South West Pod of Missouri Elderberry growers welcomed me to one of their meet-ups, where I experienced grower knowledge exchange first hand. Sherrie and Rich Hagenhoff, took the group on a tour of their Sac River Valley Elderberry Farm, discussing everything from tips and nuances of varieties to stabilisation of the berries at harvest. More experienced growers in the group offered practical advice to those starting out. We ended up in their basement tasting each other's products. It's in such settings that the real knowing exchange and relationship building happens. I was surprised how so many businesses which were all making similar products and selling in the same geographical area were so open with each other about facts and figures. I asked about that at the end of the evening, to which Debbie Mize of Whispering Elm Farm replied,

"Competition is good for business…if there is one restaurant in town there still won't be visitors; when there are 10 restaurants, it's a foodie town."

That is how elder products have become 'a thing' from nothing in the US.

Figure 46: Rich and Sherrie Hagenhoff at a product tasting session with their local grower's group (Source: Author).

I experienced similar spirit again further north in the US, with members of the MEC during the three very informative days I spent travelling in Minnesota and Wisconsin with their President, Chris Patton, another key player in the US Elderberry industry. Like Terry, he speaks and educates passionately at multiple events across the US, from the opportunities of growing elder with growers, to how to build a name for the native crop and the systems to adequately feed the market demand.

Figure 47: Chris Patton, President of the MEC, also engaged in elder growing, at Natura Farms, MN, showing the size that Canadensis flowers can be with optimal growing conditions (Source: Author).

Across the elder industry, I kept meeting advocates championing elder in the form of leaders of grower groups, COOPs and research programmes. They are instrumental in bringing all parties together, educating on all fronts (growers, buyers, policy-makers, consumers), coordinating fund raising and driving research and best practice.

7.2 Research and Collaboration

I visited numerous excellent research programmes and researchers, studying everything from elder varieties to cultivation practices and the health promoting compounds that both berries and flowers contain. General themes were that research was highly practical and industry focussed; globally there is more happening than you might think. Funding was usually sought in the form of government grants. In the US the research is conducted predominantly though extension services.

Research Assistant, Professor, Andrew Thomas of The University of Missouri, has studied elder for 23 years. The university has used a citizen science approach to gather and investigate wild selections,

finding 60-80 varieties that had useful traits, trialling them at multiple research farms and grower sites across Missouri. Two other current research programmes include analysing antioxidant profiles of elderberries according to variety and region, and investigating the effect of flower harvest on subsequent berry yields. There are also trials ongoing to try to better define fertilisation guidelines for elder.

In Portugal, Bruno Cardoso of Inovterra and Professor Silvia Roca, at the University of Aveiro, are working with growers to reinvent elderberries and elderflowers, transforming them from an exported processing crop to premium signature ingredients in added-value, locally marketed consumer food and beverage products in an EU-funded project known as Sambucus Valor, by identifying the useful compositional contents of the berries and flowers.

The equal participation of growers, processors and academics in collaborative research and knowledge exchange has allowed the rapid development of elder as a farmed crop in other parts of the world. Moreover, the strong collaborative networks and grower cooperatives are an important way of attracting research funding and ensuring knowledge dissemination.

8. Discussion

About halfway through my Nuffield journey, and in the context of talking about diverse operations, John Hayden of The Farm Between Vermont, told me, “Elder is just another layer of our farm.”

This sums up my observations from my Nuffield journey, but I would add that elder is another layer with opportunity attached. Elder is gratifyingly quick to reach full yielding stage, enviably long in its productive longevity and a UK native producing two usable crops - flowers and berries, both as positive for our health as they are delicious - ingredients that lend themselves to a multitude of market places, some of which already exist and others that are yet to be developed. Whilst elderberries are the most prevalent crop in use around the world and present an opportunity for product development in the UK, I noted that there was also more complexity and more threats to growing for the berry than for flower.

Other parts of the world are having great success in championing their own elder products from their native subspecies, investing in research and development of sustainable cultivation, processing and functional properties and, using what I believe to be more easily sustained USPs, such as ‘home-grown’, ‘traceable to field’ and ‘native plant’ status. I set out on this project with future elderflower raw material supplies for processors in mind and came back with an appreciation of the global interest in the wider products from elder, which go far beyond the traditional uses of elderflower in drinks. There is much potential for elder to add diversity, interest and potentially beneficial functions to our diets and our farms alike, much of that potential, as yet, unexplored in the UK.

Elder can be managed in a conventional, intensive orchard system. For fruit growers wishing to diversify, this may be the easiest to implement, reutilising current equipment and knowhow. Such a system may be required in certain circumstances, where berries are the key crop and there are specific threats such as SWD to be managed. However, I do not feel that intensively managed orchards are strictly necessary, especially not for producing elderflower. On the contrary, wild managing in some settings or incorporating elder into mixed or agroforestry systems make sense from a business perspective in term of fitting it into the operation. Elder is another useful ‘layer’, but not necessarily as a maincrop.

Everything elder needs to thrive is incredibly well catered for by taking a regenerative and organic approach. Building soil organic matter by incorporating manure or compost, grazing poultry beneath the trees, combined with actions such as ground cover (which all protect and promote soil health and condition), and ensuring a diversity of varieties and species in the orchard, produce conditions that are favoured by elder. In a conventional system, mineral fertilisers can be used to feed the tree, but elder is a perennial crop and will be in the ground a long time, so taking actions that maintain wider aspects of soil condition and health over the longer term, beyond just supplying nutrients, is important.

Maintaining soil health can greatly affect the ability for nutrient and water uptake even if these are continually being provided. The use of organic fertilisers and regenerative practices help mitigate risk, so it seems sensible to build a system around those principles from the start. Additionally, for someone new to growing tree crops, I believe it is easier to achieve success this way and that a more

self-sustaining, slightly lower input setup in the longer term can be achieved, since many of the approaches build in resilience (especially to extremes of drought and waterlogging, which elders are vulnerable to). Whatever the system, lower input does not mean no input. Pruning is a key practice vital for the continual regeneration of elder, as is ensuring weeding and watering in the establishing years.

As I travelled and investigated, I became increasingly aware that the subject of growing elder cannot be only about creating more flower volume. The value of elderberry and elderflower lies in flavour and nutrient composition; yield is not just about overall fresh weight but also about quality (yield of desirable chemical compounds). When designing cultivation protocols, we need to have a better awareness of the impact of growing conditions and variety on these factors.

Elderberries and elderflowers are ingredient crops, in need of rapid further processing to maintain quality and add value after harvesting, so it is necessary for growers to have at least primary processing expertise, for processors to gain growing expertise or for strong partnerships between growers and processors to be formed to ensure any move to a farmed model can be sustainable. I have seen how the closeness of these partnerships and commitments to understanding the whole chain are powerful in stimulating rapid development of a new home-grown industry. Engagement with the whole chain starts with building relationships between growers, processors, educators and consumers. That allows knowledge exchange, which accelerates development and results in collaborations forming that are necessary to be able to investigate the overriding research themes. The marketplace for wider elder products must also be developed together to ensure equal value for growers and processors ensuring motivation to create new supplies and sustain them. Growers, and processors, alike have a role to play in engaging with and educating the consumer directly to create this value for all.

The collaborative networks are also vital as support mechanisms for the industry when developing and responding to the challenges of a new crop. For example, not only would work need to be done to select the best varieties for the UK but also there will be a need to research pests and mitigation strategies. These are the areas where we particularly need to write the handbook ourselves at a UK level and where pooling data across the UK would be mutually beneficial.

I believe we need to build similar strong relationships, networks and research programmes around our own native elder, nigra, with all parts of the industry equally involved and invested if we are to make elder a sustainable UK grown crop plant and add elderflowers (and maybe even elderberries) to our portfolio of high quality, traceable, British-grown ingredients. This will require commitment between processors, growers and researchers to invest and engage in multiple-way knowledge exchange and research, led by passionate champions for the cause. We already have the latter; let's build the former together.

9. Conclusions

Incorporating elder onto your land can be done in a variety of ways. It can be managed in a conventional system, but elder is particularly responsive to organic and regenerative management practices and following many of these principles help the grower achieve success and resilience, whether the operation sets out to be organic or conventional.

Understanding elder's wild habitat and botany helps us to select an appropriate growing system that makes use of or adapts land to be optimal.

Soil preparation and amendment before planting is worthwhile. Extreme soil types and waterlogged areas are best avoided or strategies such as planting on berms should be used.

Regardless of growing system, elder requires management to thrive and be productive; pruning, access to consistent moisture yet being on well drained land and reduction in weed competition are vital.

I believe yield should encompass flavour and nutritional composition as well as volume.

The success of other parts of the world in growing a cultivated elder crop, and adding value to the crops, has resulted from the direct interactions and collaborative working of growers, processors and academics.

10. Recommendations

Farmers, researchers, processors and academics need to work with market developers for mutual benefit.

Firstly, we must trial and select varieties that perform in the UK. Assessment of compositional quality of the flower or berry should be considered alongside yield to ensure suitability for the end market. Researchers need to undertake replicated trials nationally, across multiple geographical areas, since varietal performance appears very specific to location. The creation of diverse, genetic banks of different variants will be important to bolster germplasm for the future.

Individual farmer planting of a mixture of varieties is advisable. This would not only aid trialling for performance at a local level but also it is equally as important for the resilience of the enterprise.

Monitoring and research to understand and mitigate emerging pests and diseases will be vital to protect any newly forming sector.

Forging wider UK links between growers, processors and academics to exchange knowledge and conduct trials collaboratively would greatly accelerate research and development, provide a support mechanism for growers, raise the profile of the subject and ensure value is created for all participants, making the chain more sustainable.

11. After my study tour

My study raised as many new research questions as it has answered, but it has helped me immensely to understand what knowledge is already out there that we can start to reapply and where there are still gaps in knowledge and further research is needed.

There is much knowledge that we can already work with and the next step will be trialling and selecting varieties for the UK.

I am delighted that this study has connected me with the original and also new pioneers of growing elder in the UK. I feel we are already building the foundations to become more connected together in the future. With the Covid-19 situation being current as I write this report, the need to ensure we know how to provide the ingredients that our manufacturing industries utilise, from closer to home, and not relying entirely on imports, seems even more poignant than when I set out.

Learning about regenerative and agro-ecological farming practices and systems became an accidental side study of my Nuffield journey as I realised their importance. This project also led me into the agroforestry, food forest, perennial food crop and soil health arenas and on returning home, my horizons have been immensely broadened as I immerse myself in finding out more about all of these subjects.

Editor's Note: A UK Nuffield Farming Scholarship consists of:

(1) A briefing in London.

(2) Joining the week-long Contemporary Scholars' Conference attended by all new Nuffield Farming Scholars worldwide, location varying each year.

(3) A personal study tour of approximately 8 weeks looking in detail at the Scholar's chosen topic.

(4) A Global Focus Tour (optional) where a group of 10 Scholars from a mix of the countries where the scheme operates travel together for 7 weeks acquiring a global perspective of agriculture.

The Nuffield Farming Scholarships scheme originated in the UK in 1947 but has since expanded to operate in Australia, New Zealand, Canada, Zimbabwe, France, Ireland, and Netherlands. Brazil, Chile, South Africa and the USA are in the initial stages of joining the organisation.

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Appendices

Appendix 1: I have compared and contrasted my observations of the key features of the main elder growing and processing areas that I visited during my Nuffield Farming Study.

Europe	**US and Canada**
Ancient history of human use for berries and flowers. In 1644, an entire publication was written on the subject (Blochwitz, 1677) with a medical slant, yet most of the 'cures' were what we would consider food and drinks.	Elderberry consumption dating back to the indigenous peoples of these nations, for example from elderberry seeds discovered at Native American sites (Moody, 2019).
Elder processing and growing industry, mainly traditional based. Official figures scarce but estimated at 12,000 hectares in Europe (Patton, 2019). No specific category for elder in the European agricultural censuses.	The elder industry is new, up-and-coming. Processes and products are developing at a rapid rate. Elderberry, achieved its own crop category in the last US agricultural census (2017), for the first time, with reportedly 321 producing hectares and a further 118, newly planted not yet bearing a crop (Perdue, 2019).
Tradition of consumption of both elderflower and berry has been retained in some specific countries, and you see elder products commonly on shelves; in others, these products barely exist.	No long history of elder products on US and Canadian shelves, yet consumer awareness for elder products is rapidly developing.
Industry is centred on native nigra elderberries, but elderflower production exists. It's mainly elderberries that are farmed. Farming of flower co-exists with a wild picked flower industry. Flowers are farmed only for buyers valuing traceability to field and identity preserved status. Wild harvest of elder is primarily in Central and Eastern European countries.	A newly established industry producing and selling mainly native elderberries but increasingly flower. Both elderflowers and berries are supplied from farms. There is no specific wild picking industry.

Established, mainly processor-driven industry. Product development of elder products largely 'owned' by the processor.	Establishing, mainly a grower-driven industry. Product development in the elder products category is driven heavily by growers.
Characterised by berry, but flower products also exist. Categories include: 1) Dietary supplements 2) Food colourants ….for global markets. And to a lesser extent: 3) Juice concentrate, juices, extracts ….for more local food and drink manufacturers to make consumer products. 4) Dried elderberry and flower ….for both local and global tea, food and drink and cosmetics markets.	Characterised by berry; flower products are relatively novel: 1) Berry juice concentrate, juices, extracts 2) Dried berry and elderflower …used to make food and drink consumer products for a domestic market. 3) Dietary supplements or food product with health and wellbeing claims. … for a domestic market.
The grower is seldom the brand owner of the final consumer product/brand and sells to a coop or separate processor/manufacturer, who controls the marketing and consumer awareness.	Much more prevalence of the grower being the final consumer product brand owner (or, farmers had become the processors and marketeers).
Consumer products tend to be marketed on taste and tradition. Health and wellbeing marketing tends to be left to the dietary supplement category.	Consumer product marketing, whether a food or drink or a dietary supplement, tending to be centred around health and wellbeing benefits.
Elder is a subject of academic research but the work tends to be unlinked, individual studies.	A number of research programmes about elder, they appear fairly well linked and ongoing.

Bibliography

Blochwitz, M. (1677). Anatomia sambuci, or, The anatomy of the elder [electronic resource] : cutting out of it plain, approved, and specific remedies for most and chiefest maladies : confirmed and cleared by reason, experience, and history / collected in Latine by Dr. Martin Blochwich, Electronic reproduction. Ann Arbor, Mich. : UMI, 1999- (Early English books online). Digital version of: (Early English books, 1641-1700 ; 1436:4).

Bolli, R. (1994). Dissertationes Botanicae: Notes From Revision of the Genus Sambucus by Richard Boll, Band 223, J. Cramer, Berlin.

Byers, P. (2019). Presentation slides: Elderberries:How to Get That Yield !, University of Missouri Extension, 2019 Comprehensive Growers Workshop, Jefferson City.

Calderwood,L. & Yarborough, D.E (2020). Online article: The University of Maine Cooperative Extension: Maine Wild Blueberries, accessed at: https://extension.umaine.edu/blueberries/about-2/, last accessed: 5-5-20.

Hanus (2011). Online Article: Final Report for FNC08-745:Using Commercially Available Mycorrhizae Inoculant, Compost, or Mycorrhizae Inoculant and Compost when Transplanting Small Berry Bushes, accessed online at: https://projects.sare.org/project-reports/fnc08-745/, last accessed: 12-5-20.

Hayden, N. J. & Hayden, J. P. (2019). Farming on the Wild Side The Evolution of Regenerative Organic Farm and Nursery, Chelsea Green Publishing, Vermont.

Moody, J. (2019). The Elderberry Book, New Society Publishers, Gabriola Island, Canada.

Patton, C.J (2019). Presentation slides: MINNESOTA ELDERBERRY COOPERATIVE FEASIBILITY STUDY REFLECTIONS: Assessing Market Opportunities and Commercial Applications Market Study Comments & Implications, 2019 Comprehensive Growers Workshop, Jefferson City.

Perdue, S. (2019). 2017 Census of Agriculture, United States Summary and State Data, Volume 1, Geographic Area Series, Part 51, AC-17-A-51, Issued April 2019, United States Department of Agriculture, accessed online at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf, last accessed: 9-8-19.

Senica, M, Stampar, F., Veberic, R., Mikulic-Petkovsek, M. (2016). The higher the better: Differences in phenolics and cyanogenic glycosides in Sambucus nigra leaves, flowers and berries from different altitudes.

STBOG (2019). Personal Communication during visit to STBOG (Steirische Beerenobstgenossenschaft Egen), May 2019.

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