Soilless Cultivation For Herbs

Contents

Tyfu Cymru: A Horticultural Manifesto for Wales

The Tyfu Cymru project's goal is to build the capacity and capability of the Welsh horticulture industry. Working with supply chain partners it will prepare growers and producer owned horticulture companies across Wales to adapt to future environmental challenges and position them to capitalise on market opportunities for business development and growth. This project will support the Welsh Government to realise its ambitious objectives for growth and rural regeneration through the innovative and sustainable development of the horticulture industry in Wales. Led by Lantra, working with key partners Puffin, Glyndwr University and ADAS, with funding from the Welsh Government Cooperation and Supply Chain Development scheme, it will provide a blend of strategic leadership, skills development, training and support tailored to the needs of the industry. It will draw on evidence gained from expert horizon scanning and analysis of business needs, and it will demonstrate the social, environmental and commercial benefits for businesses and the Welsh economy.

Is this your opportunity to develop your business? The grower toolkit highlights the benefits and practical tips for soilless growing and how using innovative methods with the right support can take your business forward.

What we offer:

- Funded innovative training and skills development
- A horticulture talent pool programme
- Supply chain and cluster support
- One stop knowledge hub offering an industry voice.

If you would like to find out more about any aspect of commercial growing and how to develop your horticulture business please contact Tyfu Cymru via email at **Tyfucymru@lantra.co.uk** or see what we're doing by keeping up with Tyfu Cymru on social media: find us on Facebook at **tyfucymrugrowingwales**, or on Twitter **@TyfuCymru.**

About This Grower Guide

Growing crops without using soil is widely practiced in horticulture as an efficient and cost effective method for the production of high throughput, high value edible crops. Control and the proportion of marketable yield can be further enhanced by using soilless systems under plastic or glass growing structures. Covering the crop not only "keeps the weather off" but with appropriate site logistics can integrate the use of lighting and heat to extend the growing season, and with sufficient investment realise all year round growing. The Agricultural Land Classification (ALC)[1] of Wales defines the top three grades (1-3a) as the 'Best and Most Versatile' agricultural land, and accounts for 7% of the total land in Wales. Soilless cultivation also removes any limits on cultivation imposed by soil type or the availability of space, offering a chance for growers to use a new way of growing to increase and diversify their outputs. As such, soilless cultivation has been identified as a key innovation that could be exploited to promote development of the horticulture sector in Wales. The methods used for soilless cultivation are numerous and can be tailored to suit new or existing holdings. This document has been prepared to provide summary information around soilless cultivation to help promote the uptake of new growing methods in the Welsh horticulture sector. How to establish soilless cultivation is outlined, along with advice on integration into existing production and marketing routes so that growers can implement selected techniques as part of their enterprise.

[1] http://lle.gov.wales/catalogue/item/PredictiveAgriculturalLandClassificationALCMap?lang=en

1 Introduction to Soilless Cultivation

The production of crops without soil, typically by hydroponics, using nutrient-enriched solutions with or without growing media, offers a unique opportunity for the Welsh horticulture sector. Hydroponic systems are particularly beneficial when producing herbs which can achieve high marketable yields and be sold at a premium to retailers for local consumption.

Fresh herbs such as basil, parsley, coriander and mint, are increasingly demanded by consumers as tastes broaden and there is a sustained focus on healthy, nutritious food. Herbs are well placed to benefit from this trend. Small quantities of fresh herbs can greatly enhance the flavour of any dish and while these may be integral to many regional cuisines such as Asian cookery, many consumers seek to use herbs for flavouring a range of salad or sweet dishes. From a horticulture perspective, herbs represent an ideal locally produced product: it is a high throughput, high value product which can exhibit rapid drops in flavour and quality in extended supply chains. By increasing the availability of locally-grown, high quality herb products, growers will be able to exploit an increasing consumer demand and increase the profitability of their growing enterprise. Welsh-grown fresh produce also aligns with the long-term vision of the Welsh Government for horticulture, to diversify traditional horticulture output that meets consumer demand for local produce. Welsh-grown herbs are a sustainable commodity that can either be eaten fresh or used in Welsh-made food and drink products.

Herbs are a fast return on investment crop for a hydroponics enterprise, either as a new business or as a development from an existing business. Herbs can be grown in many existing glasshouse or polytunnel structures, including those developed for ornamental use allowing growers to seamlessly expand their existing enterprise. Herbs grown in hydroponic systems can be grown at high density with short crop cycles, producing 3-to-4-fold increases yield per unit area compared with traditional methods. Gutter-grown basil can yield 1.5-2kg/m^2 cropping within 45 days for mature plants, while parsley can achieve 3 – 5 kg/m^2 within a 28 day growing period.

High planting densities also increase the efficacy of biological controls for pests and diseases in both the root and shoot zones compared with growing in the soil. Low labour costs associated with stacked or table-height production, and the ability to control the growing environment means that optimum resource efficiency can be achieved while offering a highly uniform and consistent product that has the potential to be grown year-round under protection, with supplementary and replacement lighting. Cultivation without soil also means that the crop won't become contaminated with soil; enhancing marketability and reducing washing, selection and packing costs. The recirculation of water and nutrients is 20 times less wasteful compared with soil grown systems, which significantly increases the efficiency of production. While soilless cultivation methods can be started on a small scale using simple technology, these techniques can be combined with innovative growing technology such as light-emitting diode (LED) to promote photosynthesis and extend daylength; crop sensing to monitor temperature, water use, crop health and pest and disease outbreak; carbon dioxide enrichment to increase carbon fixation by photosynthesis and stimulate high marketable yields and excellent crop quality. When technologies are combined very high yielding and efficient crop production systems can be developed.

This document has been written as a practical guide for growers who are seeking to diversify their business using hydroponic techniques.

2 Hydroponic Growing

Growing plants without soil is an efficient way to provide water and nutrients to a crop, and allows them to be grown at a higher density than would be possible in the field. It also allows tight control of the growing conditions so that optimum quality produce can be grown, and the absence of soil means that a cleaner crop can be harvested which is of benefit for herbs which may not be cooked before use. Optimum water and nutrient access also improves rates of growth, and because soil-borne diseases are avoidable, continuous production from the same space is possible.

A core feature of any hydroponics system is the use of a carefully controlled nutrient solution to provide water and key nutrients to the crop. This can be applied to the bare roots (**Fig. 1**) in substrate-free systems (such as in the nutrient film technique or NFT; **Fig. 2**), or applied to plants supported by an inert substrate. The nutrient solution is maintained as a recirculating stock which is collected after application to the crop, ensuring high efficiency of resource use and minimising the environmental impact of nutrient run-off. While this can be prepared using pre-formulated mixes, it can be tightly controlled to provide an optimum, uniform growing environment for the crop. Two key features of the nutrient solution that will require control are pH and electrical conductivity (see key terms below).

Fig. 1: Bare root systems bathe the root ball directly in a nutrient solution

Key Terms – Nutrient Solutions
pH – This is a measure of the acidity (below pH 7) or alkalinity (above pH 7) of the solution. This can have an impact on the availability of certain nutrients if the pH is too far from optimum, although this can be highly crop specific.
EC – Electrical conductivity (EC) is a measure of the proportion of ions dissolved in the solution. Nutrients dissociate into positive (e.g. K^+, NH_4^+) or negative (NO3-, PO_4^-) ions. As these conduct electricity, solutions with more nutrients dissolved give a higher EC (normally measured at µS cm-1 (microSiemens per cm). High EC can lead to plant damaged through toxic nutrient concentrations or difficulties absorbing water, or low EC can lead to stunting and other nutrient deficiency symptoms. EC changes with base water input, and should be regularly monitored.

The choice of growing system will be impacted by a range of features. Herbs can be grown for single cut harvests or kept for two to three multiple cuts, and preference for a given growing system will be impacted by this. Substrates can be used, but this will introduce additional costs into propagation and target market will have to be carefully considered. Where pot grown herbs are to be sold, however, the substrate will be included with the final product. This is especially well suited for the herbs sector where they are either to be sold for potting up and long term growth, or cut for immediate culinary use by the consumer. The scale of investment must also be considered, as more complex systems will occur additional costs for installation. Such systems will also offer a greater magnitude of control over the growing environment, ensuring greater uniformity in product and the opportunity to enhance produce quality through manipulation of the growing environment. For instance, leaf colour, flavour profile and strength can be enhanced by careful management but expert technical support and advice must be available if this is going to be implemented uniformly in the crop.

Substrate-Free Hydroponics

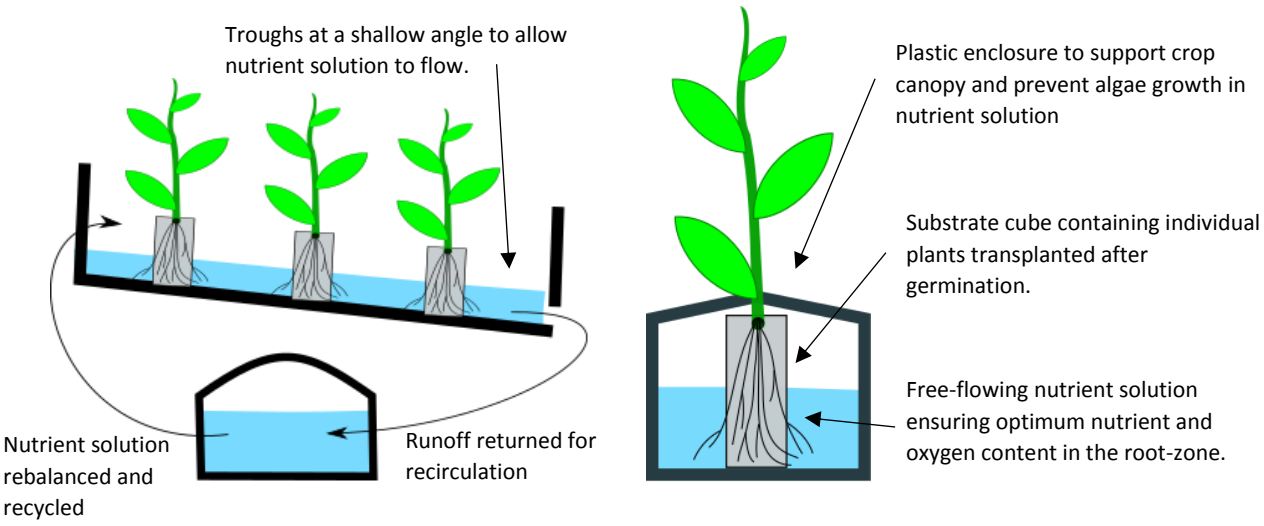

Fig. 2: Recirculated substrate-less hydroponic systems, Nutrient Film Technique (NFT)

Herbs can be grown almost completely without substrate, supported only by a small plug in which the plants were originally germinated. This system is particularly suited to short life-cycle herbs, such as those being grown for a single cut harvest or being sold as micro-herbs. The basis of these systems are that the roots of the crop are directly bathed in a nutrient solution, achieving optimum access to nutrients and water. Growing without substrates reduces costs, and can easily be used in passive (still solution) or active (pumped or aerated solution) hydroponics. Individual plants are propagated in an inert media block (typically rockwool) which is then placed into a recirculating nutrient solution.

In NFT systems, plants are propagated into small rockwool blocks (3" or smaller), which are placed into an NFT irrigation channel. This can be achieved by using channels created by folds of plastic secured to create a channel with a flat base, or shallow PVC troughs up to around 5 cm depth, 10cm wide and up to 10m long at a 1 – 3% slope. Nutrient solution is pumped in at one end at a rate of around 1L/minute, flowing past the bare roots growing out of the rockwool before collection at the opposite end and storage in a master tank prior to recirculation. The growing troughs typically include covers that can be closed flush with growing plants to keep nutrient channels in darkness to avoid algae growth. The channels should also have grooves running parallel with the channel to streamline the nutrient flow and prevent it from pooling underneath the roots. The system should also be designed so that the slope (and therefore the flow rate) can be adjusted to best suit the requirements of the crop as this changes with maturity and season. Nutrient application is normally sufficient for troughs up to 15m, but lengths longer than this will require a second feed line to prevent nutrient deficiencies in plants at the far end of the trough.

Constantly recirculating nutrient solution ensures each individual plant is well supplied with water and nutrients, and the continuous flow ensures good aeration of the roots. However, root diseases may easily spread and the system needs to be monitored as there is little buffering of nutrients and water in the growing environment if problems should occur and the plants will be sensitive to any shortages caused by a disrupted flow should there be a power or pump failure. Exposed roots also means that they are less insulated from temperatures changes, but this can be mitigated by control the temperature of the nutrient solution, keeping it above 20°C.

Substrate-grown Herbs

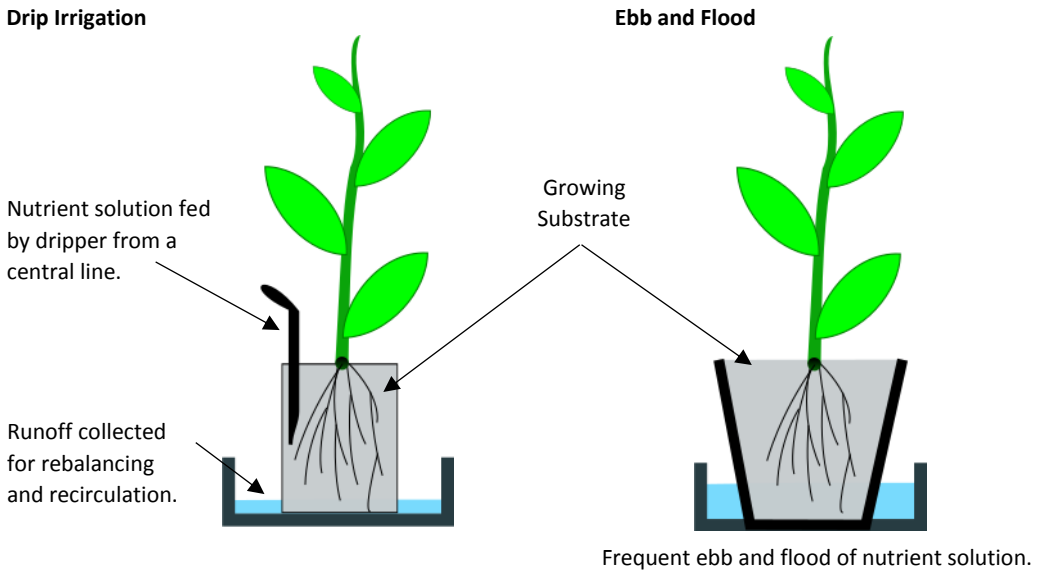

Fig. 3: Substrate systems, highlighting slow surface applied nutrient solution (drip irrigation) and rapid sub-irrigation (Ebb and Flood)

An alternative to substrate-less cultivation, herbs in substrates can also be grown hydroponically (**Fig. 3** and **Fig. 4**). The use of a substrate means that the roots are less exposed to disease risk from high volumes of recirculating nutrient solution, and the substrate can act as a buffer to changes in pH or EC. Growing substrates provide extra support for plants being grown long-term (for multiple-cut herbs) or for plants being sold as pot-grown herbs. This method is also best suited for longer-grown perennial herbs such as rosemary or lavender. Substrates also offer excellent aeration, allowing optimum uptake of nutrients. Growing substrates will need to be replaced, but this additional cost can be mitigated by recycling of organic substrates. A range of substrates are available (see page 5) and choice can be made on the basis of end product or existing infrastructure: for instance, growers that already having potting up equipment can easily use organic substrates for pot-grown herbs, while rockwool blocks can be used off-the-shelf for cut grown herbs. Growing pot-grown herbs in a peat or coir based substrate may be a suitable route for growers that already have equipment for substrate processing and potting up, such as those in the ornamentals sector.

Drip Irrigation

Suitable for large-scale growing, such as rockwool-grown herbs produced for multiple harvests, drip irrigation is a simple and cost-effective hydroponics system. The nutrient solution is kept in a master tank which is used to feed a series of tubing which ends in a dripper that inserted into the substrate. These systems can be designed to collect and recycle the runoff, but application rates are significantly lower with precisely controlled application timings than other hydroponic systems, reducing the amount of bulk storage required. Nutrient solution application through drippers is at a level where there is very little runoff. This means that the runoff is not normally captured for recirculation, simplifying application of nutrient solutions, although the precision application of water and nutrients is still far more efficient than conventional irrigation. While this can be an option for herbs, it is not as common as ebb and flood systems.

Ebb and Flood

Ebb and flood systems (**Fig. 3**) are a common form of substrate-based hydroponics due to their simplicity and flexibility, and can be adapted to suit a range of growing environments. In its most basic form, the system consists of shallow trays or benches in which the plants are placed which is periodically flooded with nutrient solution pumped in from a central master tank. Once flooded, the nutrient solution is then allowed to drain off under gravity, or pumped out, returning to the master tank for recirculation. The substrate remains at optimum water and nutrient content as this is replenished with each ebb and flood cycle, and the timings of application (both the frequency and duration of the inundation) can be tightly controlled. This system can be applied to container-grown herbs of a variety of sizes, and multiple crops at different stages can be grown in the same area, with compatible feed requirements being the only limitation. Another problem with the system is that algae can accumulate on the growing trays and will need to be cleaned out, but much less grows on the finished product due to bottom-up watering, a concern with other systems.

When using substrates, especially rockwool, it is essential that this is allowed to drain freely and that runoff nutrient solution is captured and recirculated. This ensures sufficient aeration of the roots, and efficient reuse of the water. Any system should be designed to ensure the free-flow of the nutrient solution after application. The frequency of nutrient application is heavily reliant on the crop and system used, but grower experience of crop requirements will also play a key role in determining irrigation guidelines.

Fig. 4: Substrate-based hydroponics is also suitable for multiple-cut harvests of longer-grown herbs.

Types of Substrate	
Peat	Peat has historically been the basis substrate for growing, but its use has been declining due to sustainability concerns. It offers excellent water and nutrient retention, although it is not inert and can carry a low pH. This remains a suitable substrate for pot-grown herbs.
Peat reduced and peat free blends	Typically growers will use a blended substrate mix, including a variety of components to achieve optimum water and nutrient balance. This can be based on a blend of peat, coir, green manure, woodfibre, bark and perlite. Such mixes can be purchased pre-blended to meet a range of crop requirements. The industry standard is now a 25% reduction in peat, often with bark or woodfibre, with reduced peat options substituting roughly half of the peat with aforementioned alternatives.
Peat Free (coir alone)	Produced from the waste husks of coconuts, coir is a common substrate for hydroponics. It offers better nutrient retention and buffer than rock wool and offers excellent aeration. It is relatively inert meaning that tight control of nutrients can be maintained, and is both sustainable and recyclable. Coir is used for drip-fed irrigation, and is suitable for longer-term grown crops such as roses for the cut-flower market.
Rockwool	Rockwool is an inert medium made by heating basalt rocks. It is available in slabs of a range of sizes, including propagation plugs, and in a granulated form. It has good aeration, and can be used with drip irrigation. It is excellent for propagation, but has little buffering action and can be prone to overwatering. When optimised yields are high in multiple cut systems if used correctly. It can't be recycled or composted, but can be used directly off-the-shelf.

Propagation

Typically, propagation will be carried out in-house on a continuous basis to ensure continuity of supply and to keep costs down. Seeds in a raw or pelleted form are available for bulk-purchase from a range of suppliers (see **Section 6 Next Steps**), although some herbs (e.g. basil) can be rooted from cuttings. Seed can be sown directly into propagation blocks (typically rockwool, or other substrates can be used if they can be sterilised before use) before germination at 25°C, with low lighting. Some herbs, such as coriander, can have multiple seeds sown into the same block to grow multiple mini-bunches for rapid turnaround. Nutrient solution at a lower concentration (typically around 50% of that used for normal growing) can be used during the propagation stage. New plants should only be transferred to the main hydroponic system once sufficient root growth outside of the propagation blocks can be seen – this is particularly important in NFT systems to ensure the young plants have sufficient access to water and nutrients. Short sowing-to-harvest periods (which can be as little as 5 – 10 days for micro-herbs) can be used to timetable new sowing of seed to match anticipated customer demand and ensure a regular supply of mature plants are available for harvest.

Crop Management

Care must be taken to avoid plant stress to ensure peak product quality. Stress, including root restriction, overcrowding or dryness can trigger bolting in basil and coriander (although coriander flowers are edible and can be used raw in salads or as a garnish). However, applying slight stress through high light and EC levels can stimulate a stronger flavour profile. Regular routine monitoring will be required to match control of the nutrient solution to the crop's need and environment, and it is best practice to monitor both master tank and runoff to gain an understanding of how the crop is interacting with the system. For example, under high light conditions water uptake is likely to outpace nutrient uptake, increasing EC in hot, bright conditions. More established crops will require longer, more frequent flow cycles in ebb and flood systems so that crop demand can be better matched with supply. EC, nutrient application and pH will depend on a number of factors including the crop grown, target growth stages for harvest, season, maturation and system used. Source water must also be assessed so that the nutrient solution can be adjusted to achieve optimum concentrations. Growers in hard water areas may need to acidify the water before adding nutrient mixes, and will be running at a higher EC than growers in soft water areas. While many growers use a general purpose salad/herb nutrient formulations, more specific control may be required to achieve peak oil content in mature plants. In basil, K:Ca ratios need to be kept high (around 1:1) for high oil yields, N and Mg levels must also be sustained to give high yields.

Optimum growth will be achieved where temperature and light levels can be closely monitored, and adjusted where the facilities exist. Protection under polytunnels is a bare minimum, but high volume herb growing in a glasshouse that can be heated will ensure optimum quality is maintained and will extend the growing season. All-year-round production will be possible if supplementary lighting can be provided, although this will carry additional costs and is likely to only be viable if high value produce can be marketed to a guaranteed customer (e.g. retail, local restaurants).

Planting density and harvest period will depend on the choice of system and plant types selected. Herbs grown for microgreens can be grown at higher densities on specially designed mats, and grown for two to three weeks under moderate light levels. In stemmed herbs, lower mature leaves and growing tips can be removed to promote a compact, bushy plant for later harvest. Younger herbs will have a different flavour profile to more mature herbs, and juvenile micro-herbs can be marketed into the food service industry.

Pest and Disease Control

Regular monitoring of pest and disease incidence must be carried out to avoid yield loss. Control of aphids, whitefly and mites must be planned as part of a targeted Integrated Pest Management (IPM) program. Air movement is important, especially in dense canopies of basil, to avoid development of diseases such as Botrytis in high humidity. Typical pest control measures (e.g. yellow sticky traps for the monitoring and control of aphids and whitefly).

Harvest and Sale

Pot-grown herbs can be picked and plastic wrapped when mature, and may have a shelf life of 1 to 2 weeks if watered while on display. For fresh cut herbs, one- to two-thirds of the foliage can be typically removed leaving the remaining foliage to recover for a further two or three cuts. Fresh-cut herbs generally have a short shelf life of around 2-4 days, and while some herbs can be chilled, others such as basil and mint should be kept at room temperature to prevent blackening of frost damage. Cut herbs should be loosely wrapped in plastic, and the cut ends placed in water. Some herbs (e.g. coriander and basil) can be harvested at the immature stage for micro-herbs, or as mature plants for a stronger, more developed flavour.

Postharvest Handling

Once the crop is harvested, a measure of postharvest handling will be required. For cut herbs, these should be washed, dried and sealed in polythene packets of 50g each, with larger bulk-bought herbs such as coriander and basil bunched using elastic. For food service clients, larger volumes of herbs can be packed into plastic crates. Pot-grown herbs can be placed in plastic sleeves and kept at room temperature before sale.

After washing, herbs should be chilled to 15°C to preserve them for market. Some herbs such as mint may be affected by cold injury, and are usually kept at slightly warmer temperatures. Once growers have identified how best to store their produce, they must balance this against the cost of purchasing and running cold store facilities during the season. Larger scale growers may have access to existing pack house chilling facilities, although smaller producers may wish to use commercial-size refrigerators or cooled trailers which can be hired during the season.

3 Market Information

The UK market continues to see strong growth in fresh herb products as consumers favour increasingly exotic meals or seek to follow new food trends. Current total UK herb sales are between £70-100 million, and are projected to increase by 18% annually (Fresh Produce Journal, 2016[2]) as a result of developing consumer preferences. While the market is dominated typical fresh herb products (**Table 1**) which are sold primarily as cooking ingredients or garnishes, herbs are being sold in new product types such as flavours in mixed salads or components of processed products.

Producing herbs on a local scale offers a range of benefits. Herb products could be marketed as an additional line through existing marketing channels. Customers seeking high quality, local produce through farm shops, wholesale to local trade outlets or supply into local restaurant/food service

[2] Fresh Produce Journal, 2016 (Quoting Kantar World Panel, 2016) Accessed 31/08/2016

channels would offer the opportunity to achieve strong returns on produce. Marketing to high-value, niche customers would allow exploitation of a number of unique selling points:

- Local production with short supply chains leading to short "field-to-fork" times. By keeping the interval between harvest and use as short as possible, the potency of herb products can be maximised.
- Consuming salad products close to harvest has been shown preserve freshness, retain nutrition and to minimise the risk of food-borne pathogens growing after harvest[3]. This also means produce can be sold in peak condition which is of importance for herb garnishes.
- Minimised carbon footprints, and food of a known origin marketed on the basis of locality. "Welshness" offers a strong marketing point, particularly with local consumers looking for healthy food products, sourced sustainably.

Table 1: Values include fresh cut and potted herbs.
Source: Fresh Produce Journal (2016[2]).

Product	Market Value (£m)	2014/15 Change (%)
Coriander	18.9	+13.4
Basil	13.4	+13.4
Parsley – Flat	10.1	+15.7
Mint	7.6	+19.8
Parsley - Curly	6.5	+16.6
Mustard/Cress	4.4	-3.6
Thyme	3.8	+7.2
Chives	3.2	+14.2
Rosemary	2.7	+4.3
Dill	2.3	+13.5
Fennel	2.1	+38.2

Product Choice

A wide range of herbs can be grown in the same cropping system, allowing growers to offer a wide range of products to their customers, although new cultivars may offer exciting new products. For instance, basil varieties such as Dark Opal or Purple Ruffles can be grown hydroponically to give a coloured alternative to typical forms. Cultivars can also be chosen on the basis of plant size and canopy structure to better match containerised production, with cultivars such as Elindra (basil) and Calypso (coriander) being bred for indoor production or Nufar for increased resistance to fusarium rots. Lastly, cultivar choice can impact flavour profiles, such as cinnamon, citrus or sweet thai basil giving a broad range of tastes suitable for marketing in the food service sector. Ultimately, product choice must be made on the basis of what local markets demand. If trading relationships with local foodservice stakeholders (restaurants etc.) are established engaging the customer in the decision making process will enable more informed decisions to be made about what products can be grown.

Marketing Models

Starting a new hydroponics enterprise as an extension of existing business should be undertaken with an initial goal of exploiting existing marketing channels. Growers marketing edible produce through

[3] BBC News, accessed 20/11/2016

farm shops, veg box schemes or to local markets/consumers should focus on cut herbs that can be sold in a ready-to-use state. Herbs can be sold in 50g bunches for domestic use, or up to 1kg boxes for the food service sector. Discussion with existing customers may provide an essential route to identifying product lines which would sell well. Fresh herbs may also help to attract new customers, and as a market is developed new lines can be introduced. As a business becomes more experienced with herb production, other lines including processed products (dried herbs, apothecary cosmetics or processed foodstuffs) may become an option to develop profitable side-lines. For ornamental growers without existing edible marketing routes, potted herbs (including perennial herbs like lavender) are more likely to represent viable routes to market.

Supply and Demand

The short growing periods for herbs, particularly of single cut systems, means that timing production to customer requirements can be easily achieved with forward planning. Growing under protection, particularly in a heated glass house, will offer some season extension but significant out-of-season production under lights is unlikely to be viable unless a strong market demand exists. Herb production can easily be combined with other fresh produce, particularly leafy salads, generating the opportunity for mixed products developed with customer requirements in mind.

4 Business Development

Hydroponically grown herbs may provide an excellent addition to a growers business. With careful planning a grower can entice customers by having a broad range of high value and lower value herbs, encouraging customers to source all their herbs from one supplier. By offering a selection of quick harvest leafy herbs and multiple harvest woody herbs, the grower can benefit from continuous returns during the cropping period; and if combined with ornamental crops can also open up alternative marketing streams.

Integrating Hydroponics into an Existing Business

Careful consideration must be given as to how hydroponics can be integrated into an existing growing business. Routes to market will be a key consideration – how can herbs be marketed through existing channels, and what opportunities for new markets are available. This will also cover equipment and infrastructure. If potting up equipment is available, expanding to cover substrate grown herb would be similar than for businesses without this experience. Hydroponics can be established at any scale in a range of existing structures, so it may be possible to make greater use of current farm buildings, glasshouses or polytunnels. Due to the precise formulation of the nutrient solutions required for hydroponics, it is not possible to effectively grow herbs to an organic standard. Therefore, if an existing business has an organic focus the use of chemical products will need to be accommodated.

Biosecurity and Farm Assurance

As herbs may not necessarily be cooked before consumption, extra care must be taken to ensure the produce is free from contamination. Why hydroponics avoids many of the potential risks of soil-grown production, it will still be important to have periodic testing of nutrient solutions, substrates and produce for potential pathogens. Membership of farm assurance schemes (e.g. BRC, SALSA) will include recommended procedures for fresh herb and salad production, including pesticide residue guidelines.

Investment Potential

The benefits of hydroponic production make it suitable for external support, particularly via rural development program grants administered through the Welsh Government. The current program, running until 2020, is aimed at enhancing the competitiveness of Welsh agriculture, ensuring sustainable resource management and efficiency of use, and promoting innovative farm technology. All of these themes are directly supported by hydroponic techniques, making grant support for the associated technology a realistic proposition.

5 Herb Production – A Case Study

An ornamental grower expanded his business line to grow herbs for supply to an existing customer. Herbs can make good additional product lines for nurseries growing ornamental plants for sale on to garden centres or on bigger scale retailers like B&Q and Homebase. These are often supplied as a pot crop, with the standard being 7-9cm pots, with bigger high value plants going into a 1 litre pot. Mixed herb 6 packs and baskets and tubs are also made up for sale according to the customer's request. Typical products include sage varieties (including pigmented cultivars), rosemary and mint grown from cuttings and basil, parsley, fennel and many others grown on from seed.

The nursery consists of polythene tunnels and some glass. The glass has been adapted for propagation which has allowed the nursery to become self-sufficient in rooted cuttings and seed plugs. Cuttings are taken from previous stock and are rooted in a glasshouse with a heated floor in a propagation compost while seeds are mechanically sown as multi seeded plugs and are germinated in a heated cabinet to give an optimal temperature and these are pricked out in pots or packs with transplanting machinery. The propagation floor is warmed with hot water through plastic pipes with a temperature of 180°C at the cutting base.

The seeds and cuttings are grown on to a production plan and go through to the nursery in batches. As the plants become ready they are picked onto Danish trolleys and go through dispatch to make up the orders. Usually mixed trolleys are made up depending on the needs of the customer and are then delivered by road transport throughout the UK. The peak time for sales are between March to June, with much reduced volumes after that. Some plants will be overwintered for early spring sales and may require some cutting back.

The production plan is the key driver and needs a lot of preparation and skills to predict the market demands and avoid running out, but trying to keep a low >10% wastage factor. This plan is based on experience and market knowledge and is constantly updated, although allowance is made for losses from pests and diseases and poor quality. To some extent orders for the trollies are constant and as long as a good mixed batch goes to the customer this can help ease mistakes in the plan.

Seed grown basil ready for transplanting

Rosemary cuttings rooted on a heated floor

6 Next Steps

The decision to develop a hydroponics venture must be based on a strong analysis of the potential market for herbs, both through existing market routes and the potential to access new customers. This will enable identification of likely product types and methods of production to be identified, which in turn will assist in the development of a financial feasibility study into the launching of a new hydroponics product line.

For growers inexperienced in herb production, discussion with independent advisors will be essential in identifying the best methods of exploiting hydroponic techniques, along with advice regarding crop management, agronomy and marketing to maximise the possible benefits of the new hydroponic venture. The unique nature of hydroponic growing will be its unique combination of potential challenges, and seeking advice will minimise the impact of these on new start-up ventures.

This section contains a list of suppliers, but shouldn't be considered as exhaustive, nor should they be considered as recommendations over other suppliers in the market.

SEED SUPPLIERS

CN Seeds
Main Street
Pymoor
Ely
Cambrigeshire CB6 2ED
Tel. (01353) 699 413
www.cnseeds.co.uk

E.W King & Co
Monks Farm
Coggeshall
Kelvedon, Colchester
Essex, CO5 9PG
Tel. (01376) 570 000
www.kingsseedsdirect.com

Elsoms Seeds
Spalding
Lincolnshire
PE11 1QG
Tel. (01775) 715 000
www.elsoms.com

Moles Seeds (UK)
Turkey Cock Lane
Stanway
Colchester
Essex CO3 8PD
Tel. (01206) 213 213
www.molesseeds.co.uk

Tozer Seeds
Turkey Cock Lane
Head Office
Pyports, Downside Bridge Road,
Cobham, Surrey, KT11 3EH
Tel. (01932) 862 059
www.tozerseeds.com

SUPPLIERS OF SOLUBLE FERTILISERS

ICL
Boulby Mine
Loftus
Saltburn-by-the-Sea,
Cleveland
TS13 4UZ
Tel. (01287) 640 140
www.icl-uk.uk

Solufeed Ltd
Highground Orchards Office
Highground Lane
Barnham (Nr.Bognor Regis)
West Sussex
PO22 0BT
Tel. (01243) 554 090
uk.solufeed.com

Yara UK Ltd
Harvest House
Europarc
Grimsby
N E Lincolnshire
DN37 9TZ
Tel. (01472) 889 250
www.yara.co.uk

SUPPLIERS OF SUBSTRATES

Bord na Mona
Main Street,
Newbridge,
Co.Kildare
W12 XR59
Ireland
Tel. +353 45 439000
www.bordnamona.ie

Bulrush Horticulture Ltd
Newferry Road
Bellaghy
Magherafelt
County Londonderry
BT45 8ND
Tel. (0287) 938 6555
www.bulrush.co.uk

ICL
Boulby Mine
Loftus
Saltburn-by-the-Sea,
Cleveland
TS13 4UZ
Tel. (01287) 640 140
www.icl-uk.uk

Sinclair Pro
Bridges Road
Ellesmere Port
Cheshire. CH65 4LB
Tel. (0151) 356 6014
www.sinclairpro.com

EQUIPMENT SUPPLIERS

(F): FERTIGATION, (G): GREENHOUSES, (P): POLYTUNNELS, (C): CONSUMABLES

Bridge Greenhouses
Chalk Lane,
Keynor Lane,
Sidlesham, Chichester,
West Sussex,
PO20 7LL
Tel. (01243) 641 789
www.bridgegreenhouses.co.uk
(G)

Cambridge HOK
Wallingfen Park
236 Main Road
Newport, Brough
East Yorkshire
HU15 2RH
Tel. (01430) 449 440
www.cambridgehok.co.uk
(F), (G)

Elite Tunnels Ltd
The Office
Arnhall Farm
Edzell
Brechin
Scotland
DD9 7UZ
Tel. (01356) 648 598
www.elitetunnels.com
(P), (C)

Haygrove
Redbank
Ledbury
Herefordshire
HR8 2JL
Tel. (01531) 633 659
www.haygrove.com
(P)

HBS Design
Heron Buildings
Plaxton Bridge Road
Woodmansey
Beverley
East Yorkshire. HU17 0RT
Tel. (01482) 679 344
www.hbsdesigns.co.uk
(F), (G)

Hortech Solutions
Thingehill Court
Withington
Hereford
HR1 3QG
Tel. (01432) 850 692
www.hortechsolutions.co.uk
(P)

LS systems
184 Blackgate Lane
Tarleton
Preston
PR4 6UU
Tel. (01772) 812 484
www.lssystems.co.uk
(C)

Meteor Systems
Minervum 7081
4817 ZK Breda
The Netherlands
Tel. +31 (0)765 04 2842
www.meteorsystems.nl/en
(F)

Northern Polytunnels
Mill Green
Waterside Road
Colne
Lancashire
BB8 0TA
Tel. (01282) 873 120
www.northernpolytunnels.co.uk
(F), (P), (C)

Priva UK Ltd
34 Clarendon Road
Watford
WD17 1JJ
Tel. (01923) 813 480
www.priva.com/uk
(F)

Pro Tech Marketing
Severn View
Buildwas Road
Ironbridge
Telford
TF8 7BN
Tel. (01952) 433 123
www.pro-tech-marketing.co.uk
(G), (P)

Wroot Water Ltd
Thatch Carr Farm
Field Lane
Wroot
Doncaster
DN9 2BL
Tel. (01302) 771 881
www.wrootwater.com
(F)