

The Opportunity for

Mechanisation and automation

in UK Environmental Horticulture



Executive Summary

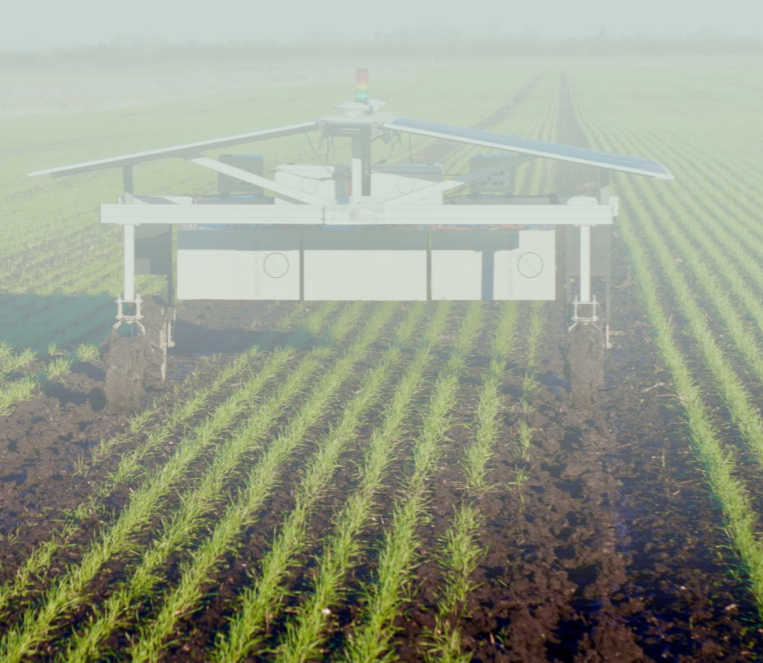
The UK's 350 or so commercial growers of plants and trees destined for the UK's 20 million gardens, parks, forests, and managed green spaces produce plants and trees worth around £1.7 billion per annum. The demand which fuels this output is set to grow in the coming years. The UK government (and its component national, regional and local government levels) increasingly recognises the value of plants, trees and green spaces as solutions to its climate change obligations, as well as achieving improved health, social and environmental outcomes.

Local and national urban greening and tree-planting initiatives and targets abound, for instance in the UK's ambition to increase from around 10% to 16.5% of its land area which comprises woodland by 2050 being just one factor in forecast future demand. The UK's demographics are changing; there will be 2 million more citizens aged over 55 by 2030, with these age groups being the highest spending on plants and trees in the UK. **In all senses, there's every reason to see UK plant and tree production as a 'growth' market.**

However, the industry is in the process of embracing change to be able to meet this increased demand sustainably and productively. The availability of labour and inputs such as water, energy, and chemicals will not keep pace with demand; the UK's growers will need to embrace change and invest in order to produce more with less. A key area of investment that is beginning to take off is investment in automation, mechanisation, and the development and application of innovative technologies to develop sustainable productivity gains in growing the UK's plants and trees. Indeed, 43% of growers that plan to expand their output plan to do so by investing in new technologies.

To date, the UK government has played a supporting role and is increasingly realising and actively supporting investment in the UK's strategic capability to grow the plants and trees it needs. To date, investment has been supported through Defra initiatives such as grant funding to match-fund capital investments in growing technologies (Farm Investment Fund), and there is an increasing body of evidence, much of it produced by government, of the environmental and social 'payback' of investing in the UK's natural capital and the green spaces it comprises.

This paper aims to provide a summary of UK plant and tree production, and sets out some of the opportunities and appetite from the sector to engage with researchers and providers of innovative new technologies to ensure that UK plant and tree production flourishes. If you're working in technology, research, or policy development, this report aims to provide data and 'food for thought' around potential opportunities to connect and work with this forward-looking sector in securing greener growth for the UK in the coming years.



Introduction to UK Plant and Tree Production

The UK's commercial growers produce trees and ornamental plants worth around £1.7 billion per annum at 'nursery-gate' prices¹, providing around 18,000 jobs². In real terms, the value of UK production has increased by 9% (adjusted for inflation) in the last 10 years since 2014¹. This growth is driven by two key forces. On the retail supply side of the market, demographics favour increasing demand. The UK's population and housing stock has grown and is set to continue growing, with more consumers coming into the 'core' gardening age groups.

Demand is also increasing as a consequence of the need to mitigate the effects of climate change. The environmental, health and social benefits of plants and green spaces are increasingly recognised by policy makers. Investments are increasingly being made by public bodies aiming to work towards tree planting and urban greening targets. There is also an emerging market for carbon credits, with organisations potentially looking to invest in planting projects for the 'carbon value' such plantations will have in coming years. *Indeed, such is the increasing realisation of this aspect of ornamental horticultural production, that the sector is increasingly recognised as 'environmental horticulture' and is referred to as such where appropriate throughout this report (see 'Notes on terminology').*

In order to meet increasing demand, the UK's 300+ commercial growers are increasingly looking to invest in the productivity and sustainability of future production. In fact, 43% of growers report planning to use more efficient technology to increase production over the next 5 years³. The nature of the challenge – producing more with less. Labour supply is set to remain a challenge for the sector, as is the need to reduce and optimise inputs – whether water, nutrients, growing media or plant protection products.

UK growers are increasingly looking to invest in technology to rise to these challenges.

Already UK growers are piloting and adopting artificial intelligence, from business applications as wide ranging as drafting copy for plant labels through to training AI in robots that distinguish between weeds and tree seedlings, subsequently controlling the weeds with lasers instead of pesticides to prevent growth.

This white paper provides an overview of automation and mechanisation in UK environmental horticulture production, including mini-case studies of the commercial application of new technologies by UK growers. The HTA supports the sector by highlighting the economic and environmental benefits of collaboration between industry and government around automation and mechanisation of the sector. But more than this, we aim to bring together businesses and other organisations with a part to play in this transformation; universities, research institutions, and technology providers as well as growers all have a part to play. With investment set to increase in UK production and the enabling technologies for greater sustainability and productivity, UK environmental horticulture is on the cusp of truly transformational change in the coming decade.

Notes on Terminology

For many years, the production of plants and trees intended for planting in domestic gardens and public green spaces for visual benefit has been referred to as 'ornamental' horticulture (to be distinguished from plants grown for production of food, referred to as edible horticulture). However, there is an increasing body of academic and economic research and evidence that these 'ornamental' plants and trees contribute hugely in terms of the environmental, social, and health benefits they deliver to society. Once planted in the environment, these plants and trees offer significant benefits for public health, air quality, temperature regulation, biodiversity, flood mitigation and more. So as such, there is a growing mind-set shift within the industry to think of and present itself not as 'ornamental' horticulture, but as 'environmental' horticulture.

However, many external or historical sources referenced in this white paper will refer to the original 'ornamental' naming, hence the use of the two terms interchangeably throughout.

Environmental Horticulture in the UK

The environmental horticulture and landscaping industry was valued at £28.8 billion in 2019 by Oxford Economics, supporting 674,200 jobs and £6.3 billion in tax revenues to the exchequer². The garden retail, landscaping services, tourism to parks and gardens and manufacture of garden goods that make up this figure, all rely upon the plants and trees produced commercially in the UK. Without a thriving plant and tree production capability in the UK, this economic contribution would be vastly reduced along with the wide-ranging environmental and societal benefits plants and green spaces offer, and the UK would rely substantially more on plant and tree imports from overseas.

The UK has a rich history of environmental horticulture production spanning hundreds of years. This production alone contributed £142 million in tax revenue to the exchequer, and £882 million to UK GDP² in 2019 (see Table 1).

The ornamental plants and flowers produced in the UK were worth £1.7 billion in 2023¹, comprising £1.2 billion of Hardy Ornamental Stock production, £330 million of Pot Plants and £179 million of Flowers and Bulbs (see Table 2).

Figure 1 shows that removing the impacts of inflation, the value of UK ornamental tree and plant production has increased in real terms by 9% over the last ten years, from £1.56 billion in 2014, to £1.71 billion in 2023.

Several factors include; increasing consumer demand for gardening and the benefits provided by plants and green spaces; a growing and ageing population feeding a larger core gardening market; and increasing demand and recognition for the role plants and can play in mitigating the impacts of climate change, underpin this growth and are discussed in the next section of this report.

An almost 18,000-person strong workforce is employed directly by these commercial growers to meet this demand (see Table 3), a demand which has significant potential to grow.

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Table 1. The economic contributions of UK ornamental horticulture production (2019)².

	Direct impact	Total impact (direct, indirect and induced)
UK GDP	£882m	£1,647m
Tax revenues	£142m	£334m

Table 2: Value of UK production of plants and trees in 2023 constant prices¹

Value in GBP (millions)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Flowers and Bulbs	-	-	£126	£168	£154	£154	£154	£153	£179	£179
Pot plants	-	-	£401	£382	£383	£389	£344	£385	£310	£330
Hardy ornamental nursery stock	-	-	£1,118	£1,141	£1,177	£1,195	£1,196	£1,313	£1,182	£1,177
UK Total	£1,542	£1,518	£1,643	£1,692	£1,714	£1,739	£1,695	£1,851	£1,671	£1,686

Table 3. Employment Supported by UK Ornamental Production (2019)²

	Direct impact	Total impact (direct, indirect and induced)
Employment (persons)	17,798	30,749

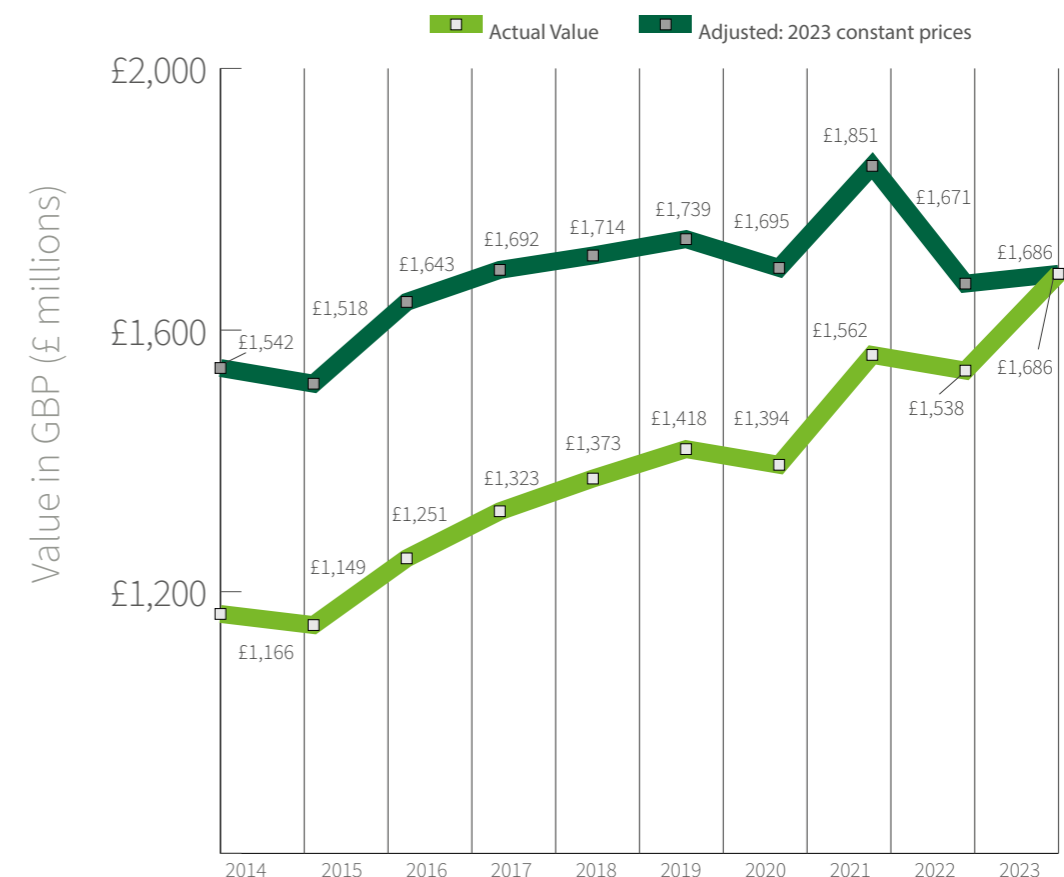


Figure 1. The Value of UK Ornamental Plant and Tree Production (2014 to 2023)¹.

Growth Potential of the Sector

Rising UK population and interest in gardening

The UK adult population (aged 16+) is currently estimated at around 52 million people⁴. Majority of UK adults report having access to a garden or outdoor space for gardening (91%), whilst 76% have a private garden⁵.

Additionally, 66% of UK adults report doing gardening regularly or occasionally in their free time or as a hobby, with the numbers rising to 83% for those aged 55 and over. Importantly, the UK has an ageing demographic, with the Office for National Statistics predicting that there will be around 2 million more people over the age of 55 in 2030 as compared to 2023⁶ (see Table 4).

It is these older age groups who have the disposable leisure time, money and are the most likely to be homeowners, meaning over the next 5-10 years the garden industry could benefit from a surge in demand for plants and garden products.

Gardening demand too saw a boost during the COVID pandemic, with the benefits of gardens and green spaces becoming more widely appreciated. In 2019, 57% of UK adults with a private garden or outdoor space used them to grow plants, trees or flowers, and in 2023 this figure was 62%⁷.

Table 4. Projected population change in the UK by age group from 2023 to 2030 (people)⁶.

Age group	Projected population change (thousands)
Under 16	(307)
16 to 24	605
25 to 34	169
35 to 44	845
45 to 54	167
55 to 64	(53)
65 to 74	1,046
75+	883

Similarly, interest in growing fruit and vegetables, and using the garden for leisure and entertainment purposes have maintained an increased appeal even after return to normalisation post-COVID (see Figure 2).

Environmental Targets

In the context of the climate emergency, the government has set legally binding environmental targets aimed at delivering net zero ambitions. In their Environmental Improvement Plan (EIP), they set out challenging targets to enhance climate resilience and improve access to nature.

The role in which trees and green spaces can play in achieving these has become more widely recognised. One report estimates that all the trees across Great Britain currently sequester around 16 million tonnes of carbon dioxide equivalent (tCO₂e) per year⁸, for example. As such, the UK-wide target has been set to plant 30,000 hectares of new woodland annually from May 2024, increasing tree and woodland cover from 14.5% to 16.5% by 2050⁹.

Initiatives such as the One Million Trees project are emerging in urban cities like Belfast and the London Environment Strategy includes policies and proposals that aim to ensure that more than half of London is green by 2050 increasing the city's tree canopy cover by 10%¹¹.

We can anticipate an increasing need for green infrastructure in the coming years to mitigate global warming. But, clearly achieving these targets requires a significant upscaling in UK production of plants and trees.

As we discussed earlier in this report, the ornamental plant production sector directly contributed £882 million to UK GDP in 2019².

But economic modelling by Oxford Economic shows that as a result of some of these demand drivers, this has the potential to rise 45% by 2030.

However, unlocking this growth potential identified is dependent on several things, including but not limited to access to labour, and technologies such as robotics and automation to enable sustainable productivity growth.

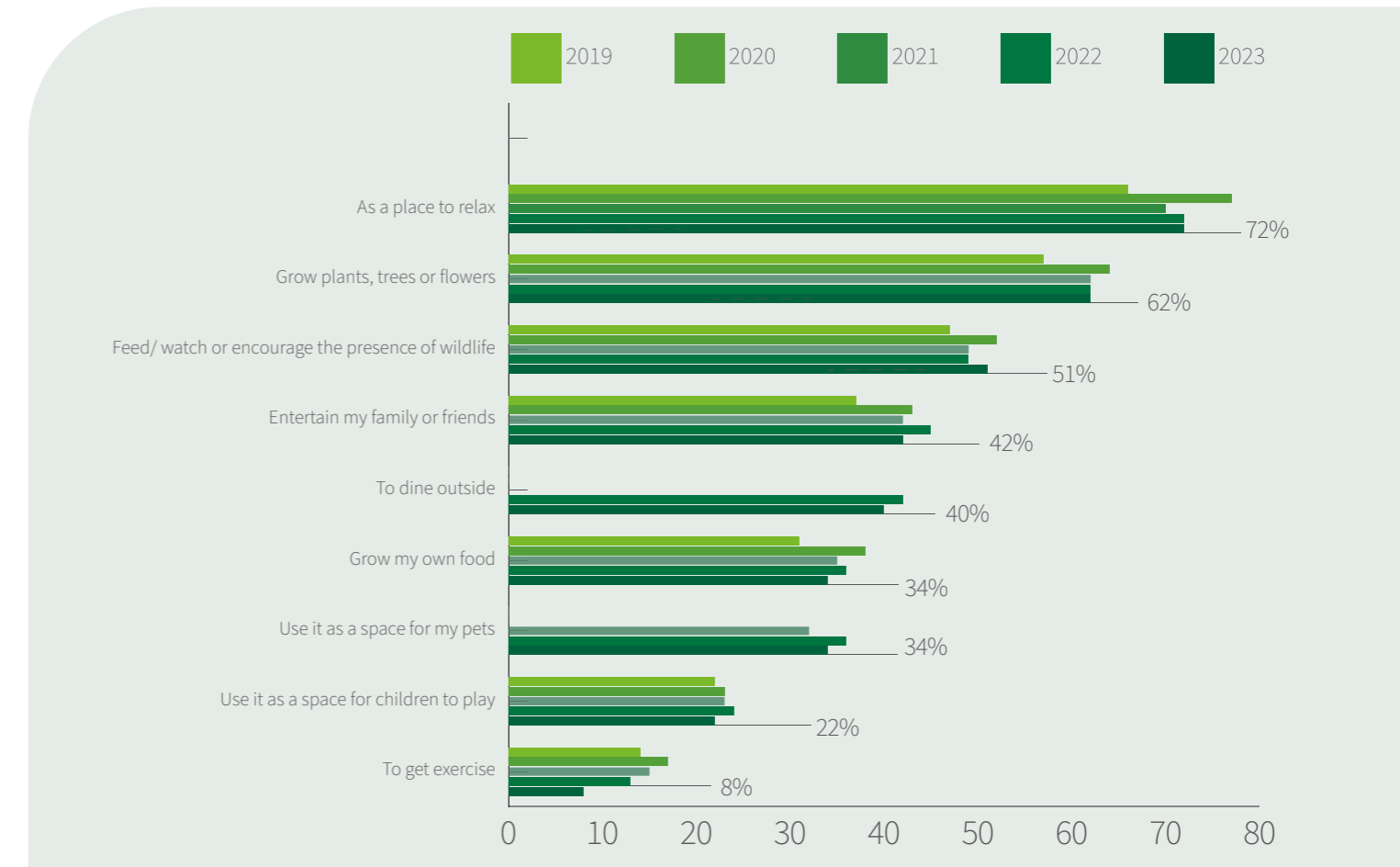


Figure 2. Participation in garden/gardening activities amongst UK adults with access to a private garden or outdoor space (2019 to 2023)⁷.

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Labour Challenges and Technological Solutions

Labour issues

Availability of labour and the necessary skills, along with ability to upscale capacity to meet demand in a sustainable manner are essential drivers in the level of growth the industry can achieve.

Our analysis shows that the sector is facing a growing wage bill. In 2021, staff costs as a proportion of growers' annual turnover were 27% on average¹²; however, by 2023 this increased to 30%¹³. Coupled with rising costs, the industry is also facing a shortage in labour supply that could limit growth potential.

Growers were carrying a 4% people vacancy rate on average in 2023. But on top of this, 65% of growers required seasonal labour, of which 45% reported a shortfall in the seasonal labour they were able to secure and the average shortfall between what they had and what they needed was 13%¹³.

The majority of growers (62%) listed a lack of applicants with suitable skills and experience as the main cause of recruitment difficulty for permanent roles, followed by applicants looking for more pay than was on offer (46%) and location of work (40%). Meanwhile, Brexit has affected the labour supply for seasonal work.

Almost two-thirds (62%) of the seasonal labour used in 2021 came from the EU, compared to 46% in 2023.

As a result, businesses are increasingly looking to automate. According to the AHDB¹⁴ "Automation and robotics, in combination with a workforce of sufficient scale and with the skills to exploit it, has the potential to enhance efficiency and productivity across the ornamental horticulture and landscaping industry".

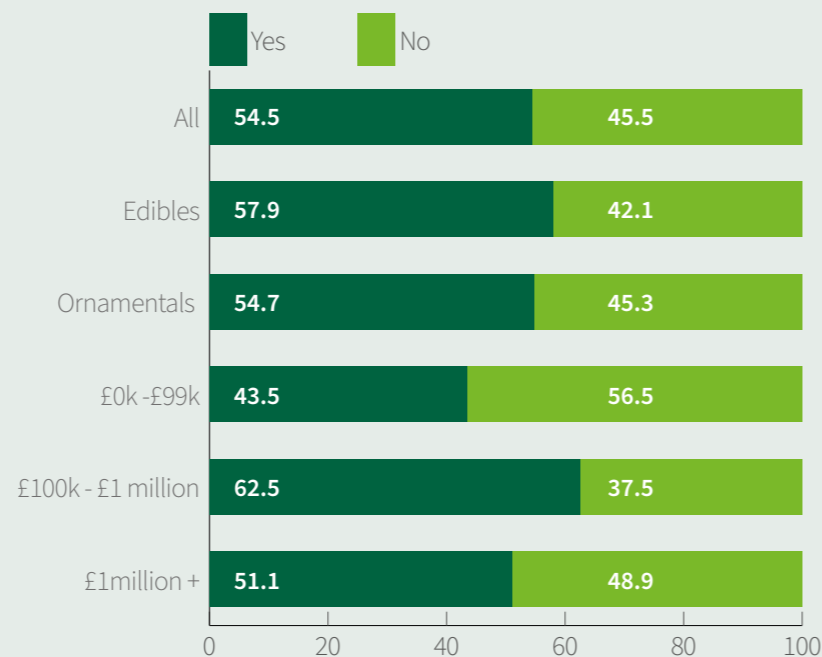


Figure 3. The proportion of growers by type and size (by turnover) planning to grow their business over the next five years³.

43% of growers indicated planning to increase the amount they were able to produce through the use of more efficient technology³

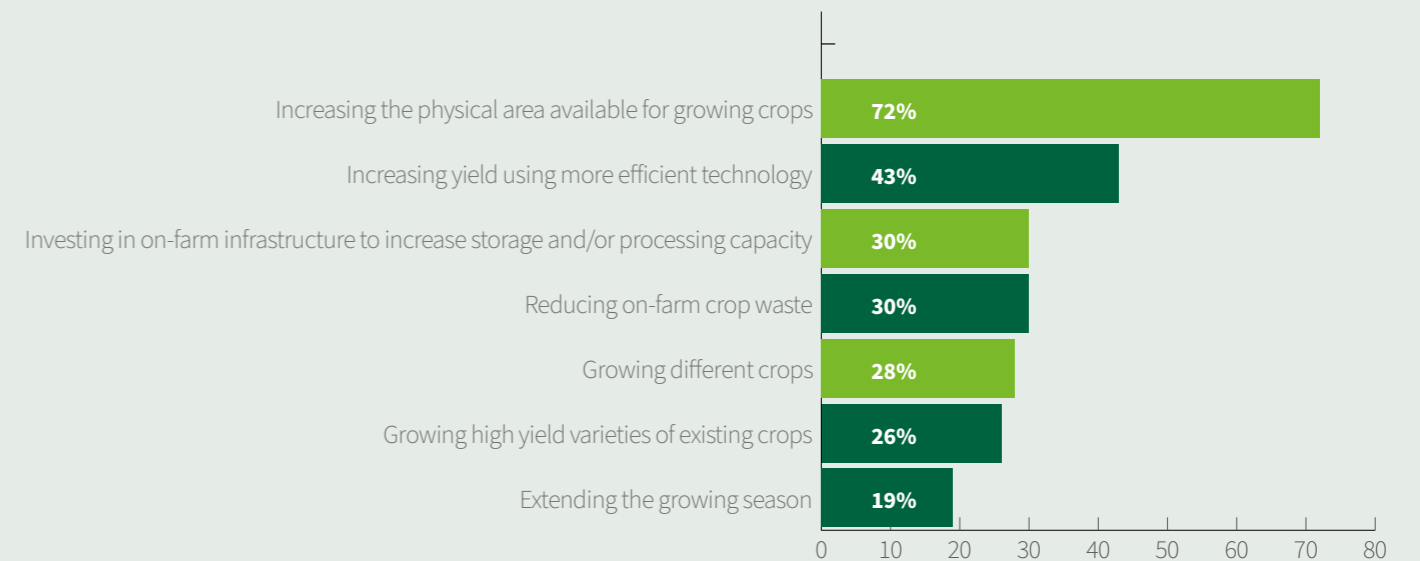


Figure 4. Methods by which growers plan to increase production in the next five years³

The 2022 Horticulture Business Survey³ found that 55% of ornamentals growers are looking at ways to grow their business over the next five years (see Figure 3).

Where growers indicated not planning to grow their business over the next five years, more than half indicated personal circumstances, but other responses highlighted factors such as the availability, restrictions and cost of inputs, confidence in the market, and availability of labour.

The most common method growers intended to use for growing their business was through increasing production (45%). Of these, 82% had already identified demand in the domestic market.

But notably, 43% of growers indicated planning to increase the amount they were able to produce through the use of more efficient technology (see Figure 4).

Whilst horticulture requires quite specific skills and knowledge from its workforce, there are many processes which could or are already to some extent being automated.

These include:

- Picking
- Bunching
- Grading
- Counting
- Packing
- Growth monitoring
- Taking cuttings/pinching
- Tray preparation
- Transplanting cuttings
- Disease/pest control
- Movement of potted plants in growing areas
- Configuring trolley shelf heights
- Transferring potted plants to trolleys
- Transport of trolleys

Funding and support for investment

To sustain and accelerate investment in new technologies to enable greater productivity and capacity, it will become increasingly important that ornamental growers are able to access investment support and incentives to help lower the financial barrier to investment. Large scale, bespoke equipment often contains significant upfront costs, but the return on investment and payback time can be significant and relatively short given the increased productivity potential. As such over the last few years, different government grants and loans have been made available to growers, including environmental land management schemes, the Farming Investment Fund, Tree Production Innovation Fund, and the Farming Innovation Programme amongst many others. Moreover, the businesses have previously been able to apply to be part of more than one scheme and benefit from multiple funding streams.

We anticipate that the 'business case' for government supporting helping businesses in environmental horticulture to invest in technologies and automation will strengthen and become increasingly entwined with the monetised value of health and environmental benefits delivered from public investment on tree planting, afforestation, and urban greening projects. Put simply, as the monetised value of environmental and social returns on tree planting and urban greening become more established, so too will the business case for public investments that ensure that the UK has the strategic capacity to grow the plants and trees it needs in future.



Example 1, Solar powered weeding machine allowing the picker to lie down and avoid bending.



Example 2, Bespoke combined harvester built with its own power unit and was developed with a grant from Scottish government.



Example 3, GPS guided fully autonomous steaming machine that kills pathogens in soil at 85 degrees Celsius.

Case Studies

Case Study 1: J&A Growers, Warwickshire

J & A Growers, Warwickshire was founded in 2002 by Jamie Dewhurst. They are the largest growers of Hawthorn in Europe and the biggest field grown producers of hardwoods in the UK. They sell around 14 million plants annually, selling to the wholesale nursery trade in the UK and Europe.

The purpose of setting up the business according to Jamie was to give nursery trade (B2B) British grown material to mitigate the potential biosecurity risks from imports, given that the demand for UK grown plants and trees has increased significantly and currently there is a shortage of UK grown material. J & A have a team of 5 full time staff members and employ around 15 seasonal workers annually.

Current challenges Jamie noted include:

- Procuring seasonal workers: Brexit coupled with a lack of interest in horticulture/agriculture in the British youth.
- Growing British products to reduce risks of diseases and uncertainty from imports, reducing costs.

Solutions Jamie has identified:

- Technology according to Jamie is the answer to many of these challenges from resolving the labour issues to increasing productivity.
- J & A Growers are at the forefront of technological innovation with connections with a number of universities from Warwick Manufacturing Group (WMG) to Lincoln University.

They have been involved with innovation and automation for nearly two decades. They were the first nursery business in the UK to invest in an optical steering system on a tractor (Eyedrive). Then in 2014 they were the first to mount a harvesting machine onto a tracked tractor, allowing more harvesting days whilst improving the carbon footprint by doing less damage to the soil structure.

They also work in partnership with some of the leading research bodies in the UK, actively seeking new technical developments.

The crops are grown to a high plant health status and are routinely inspected by APHA Plant Health inspectors.

J & A Growers accessed funding through a Tree Production and Innovation Fund which was worth £750 million and a significant number of innovation projects were/are being carried out by the universities thanks to this funding.

Part of this funding along with others has helped J&A Growers with 4 projects:

With Lincoln University and the automatic grading machine: The singulation of plants from bundles to enable robotic loading of grading lines. This is one of the most labour intensive process and will save time and effort if mechanised.

With the Warwick Manufacturing Group (WMG): Automation of the whole grading process, with a pre-commercial prototype hoped to be available at the end of the 3 year project.

Weed control: Autonomous smart pesticide application (ASPA) is being developed which will be an AI-guided machine that spots weeds and injects micro-doses of herbicide on the weeds.

CLAWS machine: This is currently in pre-commercial stage with a company called Earthrover. It scans the bed and identifies weeds using AI, then targets them using concentrated light.

Case Study 2: Hillier Nurseries Ltd, Hampshire

Hillier Nurseries Ltd are growers of pot-grown hardy and herbaceous plants, large container trees and field-grown trees based in the South East of England. They supply plants and trees to the landscape trade either direct or via their cash and carry operation, and wholesale exclusively to the 22 Hillier Garden Centres and Hillier online. They propagate plants on a small scale, with plans to increase this, manually taking cuttings, divisions and sowing seeds to raise young plants.

A major challenge for the business at present is the movement to peat-free growing media, which is requiring the team to be far more precise with watering and nutrient management to avoid crop losses. The peat-free growing media requires very different irrigation patterns, the same amount but more regular smaller applications; wetting agents are showing good results in assisting with watering. But this all requires labour to monitor and apply it.



Example 1. The probe used to understand water levels, humidity conductivity and temperature to ensure optimum growing conditions.

Hillier has a mix of sub-irrigation and overhead irrigation, across the nursery and each system seems to respond differently with different growing media mixes.

They have invested in Dutch technology called 30MHz which involves probes placed in the pots sending information on volumetric water levels, humidity, conductivity, and temperature to a cloud, which generates easy to access live feed via an app. The team can then monitor this to calculate when to apply irrigation, prevent foliage sitting wet to reduce losses, supporting the team checking each crop by backing it up with facts and taking away the guesswork. They currently operate 5 of these sensor units which had a capital cost of £5,000, along with an annual subscription fee. Hillier would like to get to a point where these sensors could automatically trigger irrigation, rather than rely on manually turning on the water following interpreting the need to via the app.



Example 2. The rows of lavenders that had just been pruned by hand.



Example 3. The pruning machine which will replace this manual labour and increase productivity.

Hillier has also previously looked at thermal imaging technology via the Water Link project to identify where plants might need water, nutrients or be under pest and disease stress; but at the time the cost of this was prohibitive.

Hillier also just recently invested in a pruning machine, which was off the shelf from a Dutch manufacturer. The machine prunes potted plants into a neat ball shape – a job that was previously done by hand by 6 members of staff who could process 210 units each per hour (approx. 1,260 per hour). The new machine has the potential to process 1,800 units per hour and will require only 3 or 4 people to operate it (namely loading/removing plants onto the conveyor belt), freeing up 2 peoples worth of labour and improving uniformity and productivity.

Hillier are looking at other ways to mechanise and automate processes across the nursery but are currently facing barriers in terms of capital investment, the need for beds to be uniform in size, older glass house infrastructure and the wide range of crops grown.

They would particularly like to mechanise the application of picture labels and barcodes to plants having seen this being done at Kempen Nursery in Holland. Kempen would typically have five varieties of plant on a five-shelf trolley, with one variety per shelf making the loading process simple. Hillier however supply 22 garden centres all with different lines and of different quantities, so the loading process is far more complex.

Hillier have invested £7,000 in an electric bed sweeper to clean empty planting beds and keep walkways clean, requiring only one operative to walk behind it, saving half a dozen staff members manually sweeping the areas with a broom. They've also applied a sweeper to the front of a tractor in similar vein.

Appendix 2

Ornamental Growers in the UK

Table 6. UK ornamental growers in order by most recent annual turnover as of 2024¹⁵

Business Name	Location	Annual turnover in most recent financial year 2024 (previous financial year 2023)
1 Greosn	Chichester, West Sussex	£197m (£183m)
2 Ball Colegrave	Banbury, Oxfordshire	£45m (£37.9m)
3 Double H Nurseries	New Milton, Hampshire	£31.2m (£36m)
4 David Austin Roses (Holdings)	Wolverhampton, West Midlands	£28m (£29m)
5 The Farplants Group	Arundel, West Sussex	£26.3m (£25.2m)
6 Coletta & Tyson	Brough, East Yorkshire	£24.6m (£26.7m)
7 Bridge Farm Group	Spalding, Lincolnshire	£24.3m (£27.9m)
8 Evergreen Exterior Services	Banstead, Surrey	£24m (£23.6m)
9 Allensmore Nurseries	Allensmore, Herefordshire	£22.7m (£23m)
10 Johnsons of Whixley	York, North Yorkshire	£18.8m (£16.5m)
11 Dingle Nurseries	Welshpool, Powys	£18.8m (£16.9m)
12 Nicholson Nurseries	North Aston, Oxfordshire	£18.2m (£13.1m)
13 Craigmarloch Nurseries	Kilsyth, Glasgow	£17.8m (£16.7m)
14 Lovania Nurseries	Preston, Lancashire	£17.5m (£18.6m)
15 Rolawn	York, North Yorkshire	£17.1m (£16.4m)
16 OA Taylor & Sons (Bulbs)	Spalding, Lincolnshire	£16.5m (£17.9m)
17 Greenwood Group	Walberton, West Sussex	£16m (£14m)
18= Anglia Group of Nurseries	Norfolk	£15m (£13.4m)
18= Syngenta UK	Cambridge, Cambridgeshire	£15m (£15m)
19 Wyevale	Hereford, Herefordshire	£13.7m (£12.6m)
20 James Coles & Sons (Nurseries)	Syston, Leicestershire	£13.2m (£12.9m)

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