A New Vision for Horticulture R&D

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1 Introduction

We see the potential of a bright future for UK horticulture. Increasing production sustainably is now a Departmental priority for Defra: “One of the aims in Defra’s Business Plan is to promote increased domestic food production, as we recognise the benefits that regional and local and seasonal food can bring to both producers and consumers alike.”(Defra 2011b). In a country where additional cultivable land is in short supply, horticulture offers the prospect of increasing sustainable output significantly because the sector is efficient in its use of land and of inputs such as water and chemicals. Improved technology will help to increase output on the most productive land as well in marginal areas, for example through hydroponics and vertical cultivation. Climate change may benefit domestic production through longer growing seasons. In addition, increased output from UK horticulture would offer benefits in terms of healthy eating, local food production, import substitution, job creation, and improved quality of life through climate change mitigation in urban areas.

The economic value of the UK horticultural sector is already substantial. Farm gate value of the ornamental and edible sector in 2009 was estimated to be just over £2.5bn (Farm Business Survey, 2009/10). Beyond the farm gate, the amenity sector through retail activity and landscaping adds a further £7bn in turnover (HTA figures). Most sub-sectors within production horticulture have already increased the value of their output substantially since 2000, especially so for fruit and non-edibles.

But UK horticulture faces challenges. The imbalance in market power between growers and their supermarket customers has resulted in margins being badly squeezed. Exotic pests and diseases are exacerbating an already difficult situation in crop protection. Input prices for oil, gas and oil-based products are increasing. Foreign competition is a continuing threat. Water abstraction is becoming more restricted in some regions. The supply of seasonal labour from overseas is also restricted.

Meeting those challenges depends in part on effective systems of research and development. The sector has relatively few big producers. Rather, it is characterised by a large number of SMEs. As a result, few producers have the economies of scale to enable them to fund their own research. For near-market research, producers pay a levy to the Horticultural Development Company (HDC). Over time, this has enabled growers to draw through into practical application the results of basic, strategic and pre-commercial research largely funded from public sources. In general, the sector has a good record in innovation based on prior R&D.

Over the last three years, there has been a substantial body of analysis arguing that the level of R&D supporting agriculture and horticulture needs to be increased in the UK and elsewhere to support increased food production and climate change mitigation (eg Commercial Farmers Group(2010), GO Science (2011), Royal Society(2010), Taylor & Herbert (2010)). In fact, for about
30 years the public funding of pre-commercial research in horticulture has been progressively declining.

Recognising the realities of the public expenditure situation, this paper sets out a new vision for horticultural R&D which aims to ensure that there is a coherent pipeline for research from the fundamental research, largely funded by the Research Councils through to product development by growers. We see this as essential if British horticulture is to achieve its potential and to contribute fully to governmental economic, environmental and social objectives.

2 Industry Trends

The UK industry has continued to change and develop to meet the technical and commercial demands of the major retail multiples. The decline in the euro and increase in food prices since 2007 have given added incentive to UK producers in both food and ornamental horticulture sectors. Nevertheless, the Fruit and Vegetable Task Force in its 2010 report (Defra 2010) identified that UK growers remain in a high risk/low return situation.

“Fruit and vegetable growing has become a high risk, low reward industry. The Competition Commission’s investigation of the fruit supply chain found that growers had been taking a decreasing share of the retail price of apples, pears and strawberries during the last ten years. Analysis by Defra shows that within horticulture, specialist fruit farms have had consistently unfavourable returns from capital over the last six years, with a large proportion of these farms returning negative incomes over this period. Other horticultural farms (including ornamental production) have fared better, but even then, around one quarter of these farms have returned negative incomes over the period. It is only the glasshouse farms that consistently show good returns on their capital spending. With low margins and the high capital requirements of competitive and sustainable modern growing techniques, growers are discouraged from re-investing in their business. This means that even if current barriers to borrowing were lifted, there may not be the demand from many growers to take the risk of investing for the future.”

Innovations in production horticulture, based on fundamental, strategic and applied research have continued to reach the marketplace, indicating a hunger for innovation where the investment in public research has been in place. The recent report from the NHF “Research into Use: The Strawberry and Brassica crops” (NHF 2011) identified quite dramatic innovations in both crop systems which had been introduced over the previous 15 years, based on research originating from multiple sources. These innovations in the strawberry case have helped to more than double the value of home production and stay ahead of imports.

The Fruit and Vegetable Task Force (Defra 2010) was optimistic that a significant increase in the domestic production of fruit and vegetables could be achieved without additional cost to central government with the implementation of a several proposals. In relation to R&D, these envisaged putting in place the machinery to better develop skills and support research and development. Hopefully, this paper helps to progress this desirable outcome.

3 Changes in R&D

The provision of R&D was examined, in depth, in the report “A review of the provision of horticultural R&D”(NHF 2008). This report examined the availability of skills, facilities and
funding to address horticultural R&D as the continuing squeeze on strategic R&D began to bite as a result of the changing priorities of Defra, the principal strategic research funder since the 1980’s. Since then, the Agriculture and Horticulture Development Board has been established as a merged organisation of all the agriculture-related Levy Boards and, more recently, the Technology Strategy Board has established a Sustainable Agriculture and Food Innovation Platform. As a consequence of this latter move to consolidate the funding of business-led innovation research, the Hort-LINK programme has ceased funding new projects. This is seen within the horticulture industry and the applied research base as a retrograde step as HortLINK provided a responsive vehicle for bringing together industry and researchers to address topical research needs.

The current institutional landscape of the provision of horticultural R&D highlights three points.

i) **Near market research**: The provision of near market applied research supported by HDC at present uses a contractor base in more than 20 institutions, 14 of which have multiple contracts. The bulk of the research has been concentrated in three organisations: ADAS, University of Warwick (Warwick Crop Centre) and EMR although other specialist centres are starting to emerge. The sustainability of this broad base in terms of skills, facilities and funding is unclear. This fragmentation, a result of the squeeze on funding which has driven privatisation and re-organisations has not created a stable applied research base. Many are operating essentially as “one man bands” and few centres have sufficient critical mass to ensure staff succession.

ii) **Basic and strategic research**: The skill base of relevance to horticulture is more broadly spread, with over 50 organisations, including for-profit companies, being involved. Some organisations are active in this area as well as near market research, although there is limited overlap between the “BBSRC intensity” and the “HDC intensity”. In the basic science arena, definitions of relevance to horticulture are, of necessity, somewhat arbitrary. However, BBSRC have indicated that they consider some £7M was spent on research projects of relevance to horticulture in 2008/9, the latest year for which project spending figures are available (Staines, personal communication).

iii) **Defra research**: The current support from Defra includes the “legacy” contracts from the privatisation of EMR and Warwick Crop Centre (formerly Warwick HRI) as well as HortLINK projects. Both of these arrangements are coming to an end and the future of funding from this source is opaque. Defra indicate that they plan to spend £29M on research relating to Food and Farming in this year (Defra 2011b).

4 Recent Developments

The issues relating to R&D in support of the horticulture industry have been rehearsed in the reports referred to above and several actions and activities have happened to address some of the issues raised.

i) **Skills and succession**  The BBSRC has established a number of Advanced Training Partnerships in agriculture and related industries. Advanced training partnerships (ATPs) bring together key stakeholders from the agri-food industry and the academic/research base to:

- provide high level skills training within the agri-food sector
• strengthen the availability of specialist scientific skills and expertise
• support flexible and responsive postgraduate development for staff
• help companies to succession plan for the replacement of their existing specialists in strategically important niche skill areas

The two ATP consortia led by Reading and Nottingham Universities have direct relevance to the horticulture industry (http://www.bbsrc.ac.uk/news/people-skills-training/2011/110523-pr-advanced-food-security-skills.aspx)

In April 2011, five Horticulture Fellowships were funded jointly by the East Malling Trust for Horticulture, HDC and the Horticultural Trades Association. They were awarded to scientists from ADAS, East Malling Research (EMR), Harper Adams and Stockbridge Technology Centre (STC). The award to Harper Adams, supports vacation studentships to increase the flow of graduates into applied research (web ref).

The provision of skilled entry to the industry at Undergraduate level is the responsibility of HEFCE. The reorganisation of teaching funding currently under way has created uncertainty as to the future in this area and how the land-based skills fit with overall approaches to Science, Technology, Engineering and Medicine (STEM) training strategies.

ii) Applied Research. The TSB Innovation Platform had “New Approaches to Crop Protection” as its first call in 2010. Projects with relevance to horticulture were well represented, with nine of the top 14 organisation providing applied research being involved in projects (web REF). However, it has proved difficult for HDC (and other AHDB sectors) to leverage their money in such projects due to IP issues and the ornamental horticulture sector was excluded entirely. An initiative from DFID for international development SCIPRID includes some horticulture projects is also funded by the Gates Foundation and the Indian Government. This multi-party approach is increasingly seen as a required response to such global challenges.

The HDC has been reviewing its strategy within the broader umbrella of the AHDB. The strategy has been recast to increase the focus on strategic issues whilst still addressing current problems (which has historically been the main driver of multiple small and short term projects).

The five elements of the new HDC strategy are:
1. Finding tactical solutions to specific problems on individual crops
2. Finding tactical solutions to common problems faced by several crop sectors.
3. Collaborating and exploiting the work of others in the UK and overseas.
4. Helping the industry to tackle future strategic challenges.
5. Communicating the benefits of HDC work to levy payers.

As part of this process, HDC is developing a Strategic Development Framework which is likely to focus on key areas of crop production and utilisation. The outputs of this process will be a clear and detailed exposition of the applied research needs for the UK horticulture industry, which should allow greater clarity for the TSB, BBSRC and other funders in shaping priority areas to ensure a ‘pull-through’ of basic research into the applied arena.

The strategy also recognises the difficulty of maintaining the R&D base if the majority of projects are small and short term, so is being developed with a view to commissioning fewer, larger projects (or programmes). The hope is that this will help support key groups of contractors
more effectively. The recently initiated SCEPTRE crop protection LINK project may be an exemplar of this platform approach.

Strategic repositioning of the HDC needs to be recognised as an important step, but one that only addresses the spending of approximately £4M of levy payers money. It can only be effective if other strategic actions to sustain and increase the volume of strategic and applied R&D take place alongside it. These fall to both the industry and to the public sector funding organisations.

iii) **Research underpinning Food Security.** The BBSRC is the lead Research Council in a cross-government programme in Global Food Security, initiated in 2010. This programme aims to coordinate research supported by the programme partners across Government departments, the devolved administrations, Research Councils and the Technology Strategy Board. Three of the four themes: *Resource Efficiency, Sustainable Production and Supply* and *Sustainable, healthy, safe diets* are of direct relevance to horticulture research priorities, and could provide a conduit for BBSRC funded work to be pulled though into relevant practice. An initiative from DfID for international development SCIPRID includes some horticulture projects is also funded by the Gates Foundation and the Indian Gov. This multi-party approach is increasingly seen as a response to such global challenges.

iv) **Collaboration and Partnership.** Collaboration between providers of R&D has been recommended as a route to promote more efficient use of scarce skills and facilities and to provide a broader research base to address research challenges.

East Malling Research (EMR) and STC Research Foundation (STCRF) signed an agreement in 2009 to provide integrated applied science to the horticulture industry. An applied R&D platform between EMR, STC and ADAS has also recently been formed.

Professor Peter Gregory was appointed in 2011 as Chief Executive of East Malling Research and Professor of Global Food Security at the University of Reading. The two organizations had already signed a Memorandum of Understanding in 2010 to foster academic, scientific and cultural collaboration.

On the funding side, the HDC has signed a co-operation agreement with the French ornamentals applied research organisation (Astredhor) to promote sharing of research outputs in the most efficient way as well as considering joint funding of future projects. HDC is currently investigating collaboration opportunities with Eire (Teagasc), with a view to signing a collaborative MOU.

5 **Elements of a new vision for R&D**

Looking back to the 2008 NHF report on provision of R&D, the same broad set of strategic options (Table 1) remain relevant today and we have seen in the preceding sections where progress has been made in some of these.
A new vision recognises the evolutionary nature of all of these issues while focusing now on four key strategic areas for action.

**Strategic Area 1: Strengthen Industrial Engagement to boost leadership and investment**

Recent studies have highlighted the vital role played by the industry in bringing research into use. Focus and commitment from the industry side provide drive to pull innovations into use. The HDC can represent the producers, with a particular role to be the voice of the small operations with little or no research capability. However, they cannot provide coverage of the entire chain. The Fruit and Vegetable Task Force is an example of a temporary grouping with a more complete coverage of the industry from retailers, representative bodies and large research-active producer companies.

For the future, it is likely that the broader industry, beyond primary producers (i.e. all those organisations making a profit from food & ornamental production), will need to become much more deeply engaged with the development of strategy, advocacy for research and leveraged research funding schemes if the relevant innovation capabilities and skills are to be maintained during times of extreme research funding pressures. It is likely that this will be a critical determinant of the volume of funding for strategic and applied research. The new Waitrose Chair of Sustainable Agriculture at Aberystwyth University’s Institute of Biological, Environmental and Rural Sciences is an encouraging example of such food chain engagement. The NHF has argued previously that quantification of the current R&D spend in the industry would be a powerful tool to seek leveraged funding. In addition, systematic steps should be taken by funders and industry bodies to document, showcase and evaluate examples of innovations and their origins to underpin support from public and private sector of long term support for research.

The horticulture round table, Fruit and Vegetable Task Force and the Food Research Partnership are all forums where the senior industry engagement has been brought together with government departments and funders to address common challenges. It would make excellent sense to ensure this level of engagement in the future through some mechanism to address issues such as

- Quantification of industry R&D spend
- Industry Innovation strategy
  - Targets and strategies for UK production by sector
- Internationalisation of horticulture industry innovation
  - EU Framework 8 research and innovation

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<th>TABLE 1: Strategic Options in 2008</th>
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<td>Present a new agenda for R&amp;D in support of agriculture &amp; horticulture</td>
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<td>Forge provider partnerships</td>
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<td>Exploit existing funding sources</td>
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<td>Explore new funding sources</td>
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<td>Broaden industrial engagement</td>
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<td>Increase the efficiency and effectiveness of R&amp;D delivery</td>
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<td>Review HDC R&amp;D strategy</td>
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<td>Strengthen collective leadership</td>
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*Source: NHF 2008 Table 9*
There may well be a role for the TSB-funded Knowledge Transfer Networks in facilitating these broad linkages.

**Strategic Area 2: Joined up public sector funding systems to improve innovation outcomes.**

The pressures on research funding are unlikely to diminish so the justification and advocacy for strategic and applied funding must be shared between industry and the public sector researchers. The renewed emphasis on food security at global and national level provides a vital spur to the development of well integrated research funding systems to best ensure innovation and impact. The ornamentals sector is now recognised as contributing to climate change mitigation in both town and country areas as well as contributing to human health and wellbeing so cannot be ignored in this discussion (UKNEA 2011). The significant promises of research funding relating to food security (within the cross government Global Food Security Programme) and climate change (within the Department for Energy and Climate Change programme) must be addressed for the horticulture industry.

In addition, recognition of the Agrifood industry as one of the largest manufacturing sectors in the UK should surely provide impetus to public investment in this productive industry as one of the routes to the high level rebalancing of the UK economy over the coming years. The TSB is already funding Technology Innovation Centres in areas of advanced manufacturing; there is a strong case to develop a similar technology clustering concept for the horticulture/food industry.

The challenge is to ensure that the major investments in basic research (largely funded by BBSRC), are linked effectively to the challenges and innovation processes of industry. The bulk of basic research in both institutes and university labs is driven primarily by scientific opportunity and new technologies rather than by addressing identified challenges. Innovative approaches to engage the capacities of basic science with industry challenges are being developed by research funders. Two particular examples are the TSB Innovation Platform where funding is addressed to industry-defined areas and the awards are provided to industry-led research consortia. In a similar vein, the BBSRC “Industry Club” mechanism has been used to direct basic science projects at research targets defined and co-funded with industrial members of the club. However, there is still a widely perceived gap between even the best targeted basic science and the practical implementation which cannot be filled only with the £4m pa of HDC research. Other mechanisms are required to pull the basic science towards innovation and application. This generic issue is being addressed currently by the Food Research Partnership and the outputs must feed into specific actions.

**Strategic Area 3: Skills and Facilities for delivery of innovation.**

The review of provision of R&D confirmed a general impression that there is a mismatch between supply and demand for some physical infrastructure. A rationalisation plan would be one way of making more efficient use of these facilities and reduce costs and some progress has been made in the intervening period through strategic alliances. It would seem prudent for the industry and funders to have a view on any key components of both physical infrastructure and biological resources that they are not prepared to leave to the vagaries of research funding and
local financial decisions. HEFCE, BBSRC and Defra all have strategic needs to access facilities and have made some attempts to define nationally important facilities in agriculture which should be broadened to include horticulture.

The skills agenda at the postgraduate level seems to be well served by the recent initiatives and there may only be a need to ensure full participation by industry in the ATPs rather than a need for further initiatives. Provision of Undergraduate s remains the preserve of HEFCE.

Strategic Area 4: Internationalisation to increase funding for applied research

The horticulture industry is now global, as can be seen from an inspection of any local supermarket. How can the UK research base help to increase the innovation and profitability within the UK against this background? It is clear that tailoring of international research outputs to the local conditions through applied research is one area which is already supported by funding from HDC and industry themselves. In addition, there seems to be an opportunity to work in collaboration with international research partnerships to make best use of the EU research infrastructure to promote the uptake of the latest relevant research and policy developments (eg IsaFruit http://www.isafruit.org). The UK industry at present makes less use of EU funding than in Germany or France, where the funding in FP7 was approximately 33% of the total in contrast to the UK where it amounted to only 24% (BIS, 2010). Given that there is a specific innovation and competitiveness agenda in EU funding, a systematic effort to gain more support for industry-driven proposals is merited.

6 Conclusions

The new political focus on sustainable food production has recognised the need for research and development as a vital component of a sustainable food system, as Governments have started to move away from the laissez faire, market-led approach of the last 30 years or so. The ornamentals sector is now recognised as contributing to climate change mitigation in both town and country areas as well as contributing to human health and wellbeing so cannot be ignored in this discussion. The high-level understanding of the issues and what is required have been rehearsed now in numerous reports from UK government and elsewhere, providing encouraging evidence of joined up thinking in a complex area. The NHF reports over the last five years have supported these high level messages in specific relation to the UK horticulture industry and the particular challenges faced by the innovation system due to declining funding and organisational change amongst the bodies delivering relevant research. As argued above, for the future it is likely that the broader industry further down the supply chain will need to become much more deeply engaged with the development of strategy, advocacy for research and leveraged research funding schemes if the relevant innovation capabilities and skills are to be maintained during times of extreme research funding pressures.

7 References

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