R&D Requirements for the Cut Foliage Sector 2016-2021

A proposed strategy to develop a sustainable sector

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Summary

Irish foliage is recognized as a high quality product that is in demand all year round. It has a competitive advantage as a result of the mild Irish climate which suits the production of a wide range of plant material that the market demands. Cut foliage production has developed from a minor crop on farms to the point where full-time specialist growers have become established. Today, the sector has an annual turnover of €3.7 million employing 35 full and 100 part time staff and has the potential to achieve €20 million turnover and 400 full time equivalents as set out in the Harvest 2020 targets.

Research and development is vital for underpinning and supporting the continual development of this fledgling industry, particularly given the current stage of development and the substantial potential for growth and expansion. The proposed strategy is a sector led initiative addressing the real needs of the sector as identified by growers, foliage experts and marketing personnel. It highlights the current low level of investment in R&D which is wholly inadequate to develop the sector to its full potential.

The strategy is intended to give an insight into the R&D requirements of the sector; and also to inform funding agencies and research providers on issues and priorities concerning R&D, and to assist in guiding the content of future national research funding programmes and projects.

Three thematic areas of applied research & development are identified which require support for the continuing development of the sector. These are:

- **Plant Screening** – to identify a range of 'newer' and innovative plant types to continuously excite an expanding market; utilising biotechnology techniques for breeding of newer types is a medium term goal while screening available collections is a short term goal .
- **Agronomy systems** - to improve efficiencies in terms of yield and quality of selected lines (including native woodland species) incorporating the investigation of non-chemical pest management practices thereby maintaining high foliage quality while minimising any impact on the environment
- **Adding value and new product development** – there is a need to add value to raw foliage product at foliage processing level using paints, glitters, dyes, scents etc. to increase the diversity of end use.

A programme of work is outlined to implement the R&D agenda which includes the establishment of a centre of excellence for the foliage sector. This would be developed through the establishment of a cut foliage agronomic systems facility which builds on the existing R&D facility.

Contents

Page

1. Foliage Sector in Ireland 3

2. Meeting the needs of the Foliage Sector through Research and Innovation 4

3. Review of Current R&D 5
   - 3.1 Coordination
   - 3.2 Teagasc programme
   - 3.3 University projects
   - 3.4 Personnel resources
   - 3.5 Research facilities
   - 3.6 Research Intensity
   - 3.7 Funding
   - 3.8 Issues

4. Priorities for Future R&D 11
   - 4.1 Screening & Selection of new species
   - 4.2 Development of agronomy systems including integrated pest management
   - 4.3 Added value in foliage

5. Implementing the R&D Agenda 14

6. Extension 17

7. Resources and Linkages 17

Appendix 1 Outline of Research & Development Work Programmes 19

Appendix 2 Budget & Costs for Foliage Agronomic Systems Facility 20

References 21

1.0 Foliage Sector in Ireland

'Cut foliage' from various tree and shrub species is the greenery used as filler in bouquets of flowers for supply to supermarkets and wholesale markets in UK and Europe. Irish foliage is recognized as a high quality product demanded all year round and has a competitive advantage given that the mild Irish climate suits the production of several demanded types. In Ireland, cut foliage is an emerging industry supplying an export market that has grown substantially in recent years and is expected to continue to grow, as Irish foliage is recognized as being of very high quality (Burke, 2012). Recent consumer research however suggests that the UK view of foliage may be changing as consumers selected bouquets with foliage rather than without, citing a 'more natural' and 'fresh' look to the bunch (Stephens 2014).

Currently, there are 20 growers located in the south of Ireland mainly in counties Kerry & Wexford and between them they have 250 ha of cultivated cut foliage. This area delivers 5 million stems of a range of foliage species for export, and coupled with wild foliage products, is worth in excess on €3.7m in export sales. When recent plantings come on stream over the next 5 years, 30 million stems will be available for the export trade. The industry employs 35 full-time with 50 full-time equivalents at peak periods. Foliage Ireland[1] in their plan for cut foliage development and who oversee the development of the industry are confident that Food Harvest 2020 targets of producing foliage valued at €20 million and generating 400 full-time jobs equivalent in rural Ireland can be met.

Sales and marketing is carried out by the Kerry based company Forest Produce Ltd. They organise the harvesting and processing of cut foliage from a purpose built premises in Tralee and a rented property in Wexford. Cut foliage is delivered to flower bouquet packing companies in UK and elsewhere in Europe. Adding value to the currently grown Irish species is a main feature of the future plans of the foliage processors.

Research & knowledge transfer is currently provided primarily by Teagasc and the cut foliage specialist under a programme of work involving Teagasc, Ashtown, Teagasc Kildalton and extension trials with growers in Wexford and processors Forest Produce Ltd. in Kerry.

[1] Foliage Ireland comprise T eagasc, DAFM, Bord Bia, Enterprise Ireland & Industry Representatives (Forest Produce Ltd & Growers)

According to Stephens (2014) the cut flower market needs innovation in the foliage sector. The category has been badly neglected by both packers and retailers. Flower packers and their designers confirmed that they are actively seeking innovation and new products in the foliage range. These are seen as a way of differentiating the supermarkets' offer and adding value to their premium ranges. This, together with the results from the recent flower research where consumers appear to have a new interest in foliage in both mixed and mono bouquets, shows that there is clear potential to develop a wider range of foliage specimens and cultivars (ibid, 2014).

The proposed strategy, a recommended action in the Teagasc plan for development of the Cut Foliage Industry to 2020 (Whelton, 2014) is a sector led initiative. Placing the needs of the customer in the centre of the strategy as informed by growers, foliage experts and marketing personnel is critical to its success.

2.0 Meeting the needs of the Foliage Sector through Research and Innovation

The continuation and expansion of applied research support is now more vital than ever in underpinning and supporting the continual development of this fledgling industry, particularly given the current stage of development and the substantial potential for growth and expansion. There is a need for scientific support and expertise in several areas to ensure that best practice is followed in all areas of the supply chain.

Innovation - In an era of rapidly changing fashion, lifestyle and preference, industries at the forefront of presentation of natural products such as foliage, need to exploit all the raw materials available to them. The primary vehicle for achieving progress in this area is the continuous investigation of novel plant species for their suitability as foliage candidates. The intrinsic qualities for this role are well known, but the variable characteristics of novel species like colour, texture, shape etc. are legion and will add richness to the store of different types of foliage already available. While a number of new species has emerged in the past couple of years, it is becoming very clear now that as the popularity and increase in demand for Irish foliage continues, the rapid introduction of better forms of already good lines for use in innovative bouquet designs of the future will have to be expedited.

Crop Husbandry - Given the expansion in production of new species, the application of mechanised operations in pruning and harvesting will have to be adopted to ensure economic production is maintained but currently little if any research has been carried out in this regard. The adoption of Integrated Pest Management (IPM) practices under the Sustainable Use Directive (SUD) is now beginning to take centre stage in the husbandry aspects of foliage production. IPM is essentially

good, sound farming practises such as growing competitive, healthy crops, choosing the correct variety, practicing good crop rotation and applying pesticides only when necessary to get the most out of them. The SUD now makes IPM part and parcel of growing crops and requires a focused programme of work. The foliage sector has a green image, mainly fostered by the fact that the low value of the crop has restricted the economic value of a large scale application of pesticides. However there is much scope to reduce these inputs further, by the adoption of cultural approaches to certain crop production strategies such as the use of mulch covers to reduce weed and mollusc damage. Medium term strategies such as the adoption of flower strips between crops need to be scientifically validated as well as identifying crop injury thresholds from the main identified pests and diseases. Also a programme of identifying the most injurious pests & diseases needs to be completed.

Added value – Adding value to foliage in the processing process is vital in the value chain and expansion of the business. Facilities for glittering, painting and dyeing foliage's have been installed in the processing plant and the support of expertise in these areas should be accelerated to deliver the necessary products to the market place.

Environment - Customers are constantly presenting suppliers with new challenges and none more important than those concerning our environment. Methods of production and processing of raw material will have to be developed in ways that will not be injurious to nature and the environment. Adherence to best practice in the production, harvesting and processing of cut foliage product is now necessary to meet Global Gap quality assurance - a pre-requisite within the industry.

3.0 Review of Current R&D

3.1 Coordination

Research and knowledge transfer for the sector is coordinated by a Teagasc foliage expert on a part-time basis who also has responsibilities for other horticultural crops. The direction of research is overseen by Foliage Ireland which is a stakeholder group comprising representatives from growers, sales and marketing, researchers and officials from DAFM. Research and extension is carried out mainly by the Teagasc foliage expert with input from growers and the sales and marketing company Forest Produce Ltd (FPL). Some research projects are also occasionally undertaken by universities, but on an ad hoc basis and mostly when funding opportunities become available.

3.2 Teagasc Programme

Production protocols **-** The Teagasc programme comprises an RMIS (Research Management Information System) project aimed primarily at developing production protocols for some of the currently important cultivated species and some emerging new species. The programme involves Teagasc Kildalton with extension trials on growers' holdings in Wexford and on sites managed by Forest Produce Ltd in Kerry. Foliage test trials (1 ha) have been established at Teagasc Kildalton College in 2011 with financial support from Bord Bia, where a wide range of plant material is being screened for suitability for foliage potential. Some winners have emerged and these are being expanded commercially while basic trial work continues on others which are still at the pilot phase. Piloting potential candidates on extension sites in Wexford and Kerry aims at moving these species from pilot to commercial phase, following trials on main husbandry issues.

Pest monitoring **-** a monitoring programme on a key foliage pest – yellow flower thrips (*Thrips flavus)* is being co-ordinated by the foliage specialist with the help of staff from FPL. Entomology expertise from UCD and Teagasc is engaged to support the monitoring programme on the ground. This entomology expertise was necessary initially to help identify the pest and subsequently to help set up a means of trapping and monitoring the pest, co-ordination of data collection and analysis & interpretation of results in a manner beneficial to the industry.

Technology transfer **-** findings from the current programme are disseminated by the foliage specialist to the industry via in house specialist workshops, field walks, technical notes and relevant fact sheets and articles in the press.

3.3 University/Third Level Projects

Eucalyptus pest species **-** a 3 year PhD programme funded under the Teagasc Walsh Fellowship is investigating biological control of the Eucalyptus leaf beetle - *Paropsisterna selmani* in Ireland which poses a significant threat to our commercial foliage, biomass and forestry industries.
A STIMULUS funded project (07 533) led by Teagasc involving UCD was critical in establishing the life history and reproduction traits of *P. selmani* in Ireland. Climate is predicted to play an important role in the future spread and establishment of the species in new areas in Ireland and U.K.

Adding value to foliage **-** a recently completed project funded by an EI Innovation Voucher engaged a post- Doctoral student at DIT which focused on an added value aspect of foliage. The project

examined the use of artificial dye to alter the colour of some important foliage species such as Rhododendron and Eucalyptus thereby increasing their value and uses in product development.

Evaluating flower filler species **-** Following recommendations made in Stephens (2014) evaluation of some flower and flower fillers are being conducted in Tralee and Teagasc Kildalton College. This engages the protected crops lecturer and a technician at Kildalton College at key times such as planting, harvesting & recording in the supervision of a number of student projects as part of the Level 6 FETAC programmes. The project work aims to fill gaps in information on aspects of production of some foliage and flower filler species.

3.4 Personnel Resources

The total time spent on R&D and extension in the sector is relatively small and is considered inadequate (see under Research Intensity) particularly given the dynamic nature of foliage & flower market demands and the significant growth potential of the business. Research staff comprise only one half time foliage specialist employed by Teagasc who covers not only the planning, establishment and assessment of field trials but has also an important advisory role in supporting growers. University input is sporadic and transitory and very dependent on available funding.

Currently, Teagasc personnel between them spend approximately 120 man days on cut foliage work with the most of this time being spent on the enterprise by the Teagasc cut foliage specialist.

A small project on foliage improvement technology being carried out at Teagasc Ashtown and some support by the Teagasc Entomologist on the pest monitoring programme under Integrated Pest Management accounts for the remainder. The industry has taken the lead in developing a pest and disease identification course to increase grower understanding of the pests involved in the common foliage crops, however this professional education needs to be continuously supported and developed.

The cut foliage specialist relies on the support of marketing & processing company - Forest Produce Ltd for labour for the establishment and maintenance of trials on the various trial plots at key times. Any recording that is necessary, particularly at harvest times, is also supported by staff of FPL Ltd. Total labour from Forest Produce Ltd accounts for 30 man days. One of the farm staff in Kildalton helps with the maintenance of the trial site at the college. This work is supervised by a college technician.

3.5 Research Facilities

The Teagasc foliage specialist and university researchers and students have access to a number of facilities:

- ***Test sites***
    - Teagasc Kildalton Test site - this is a 1 ha site on which contains a collection of a wide range of ornamental plant material. The site acts as a clone bank and observation area for new species and varieties that have potential for foliage production. There are various numbers of plants of individual species ranging in anything from 20 per species for observational purposes to larger numbers of up to 200 of others which are established in randomized plots to allow for small plot replicated trials on aspects of agronomy such as pruning.
    - Growers fields – currently two growers (one in the south east and one in the south west) host small plot foliage trials. These are replicated plots for assessing climatic adaptability, agronomy aspects such as pruning, weed control and pest and disease susceptibility.
- ***Laboratories***
    - Teagasc Ashtown – state of the art microscopy and culturing techniques are used to diagnose pathogen types in a recently equipped new laboratory at this specialised Horticultural facility. Other laboratory facilities including highly specialised micro-propagation & radiation equipment is available for highly specialised plant biotechnology work.
    - Universities – college laboratories are available to students for analytical work on projects.
    - Kildalton College – a range of microscopic equipment in a well equipped laboratory is available to students for pest and disease identification and other analytical project work. Refrigeration equipment including a shelf life testing laboratory is also available for post- harvest technology work.
    - Processing facility – Forest Produce Ltd have recently built a modern painting, glittering and snowing facility at their premises in Tralee. As well as the current uses, the facility is available for use in experimentation in the development of processes and techniques of dyeing, scenting etc.

3.6 Funding

Sources of funding

Teagasc is currently the main source of annual funding for research and knowledge transfer. The industry contributes 15% of the total spend through the provision of labour for establishment and maintenance of field trials. Current breakdown of funding is as follows:

Item	Amount €
Teagasc RMIS Project	15,000
Staff (including Walsh Fellow)	40,000
Forest Produce Ltd (labour)	10,000
Total	65,000

Given the present production levels and forecasted increase as a result of recent plantings, the sector will grow significantly over the next 5 years. If the industry is to be sustainable and able to compete with international producers greater investment in R&D is required. Current funding levels are seriously inadequate given the fact that the industry is predicted to increase in output from €3.7M to €20M by 2020.

3.7 Research intensity

R&D intensity is a measure of a sector's R&D spending in knowledge and technology and is the main driver of innovation. R & D expenditure and intensity are two of the key indicators used to monitor resources devoted to science and technology worldwide.

Research intensity is calculated as the percentage annual spend on research on turnover. Currently the research intensity for the foliage sector is 1.7 %. This figure would be considered low in comparison to other enterprise start-ups in Agriculture. The required level would be expected to be in the region of 5.0 % on present turnover which is 3 times the current spend.

Given the predicted increase in output, the research intensity should be in the region of 3% of € 20m or €600,000 by 2020 ie. almost 10 times present amount. Again this indicator serves to illustrate the inadequacy of current investment in R&D for the foliage sector.

3.8 Issues

While there is an R&D infrastructure in place to support the foliage sector it is rudimentary and inadequate to meet current and future needs. Key issues are:

- Funding - Low level of annual funding (€65K)

- Researchers - Only a half-time researcher/coordinator dedicated to foliage R&D which is insufficient time undertake the level of activity required.
- The foliage specialist undertakes the vast majority of the research on foliage presently and also works as the knowledge transfer officer and adviser to the growers in expansion of the industry.
- Field testing – field trials scattered across the country leading to inefficiencies and increased travel costs. Variation in maintenance timing and standards between growers can compromise the results from trials.
- Trials are not fully scientific in many cases which under-mines the quality of work being carried out and validity of the end result.
- Extension trials on grower s holdings run the risk of being jeopardised as trials areas can be mistakenly harvested by workers thereby rendering the trial useless for recording & analysis. Also, when certain tasks need to be carried out with the aid of growers, inevitably it may not be done as they may have other pressures and priorities
- Given lack of resources at key times, important recordings have been missed.eg. recording of optimum harvest date and shelf life of species such as Echinacea which has a narrow harvest period and relatively short shelf life. Further; records of growth patterns at different site locations varies from season to season – this needs frequent monitoring to ascertain accurate picture of species growth habits which impacts on shelf life and period of market availability.
- Given the nature of the species currently being grown some for the first time as a 'crop species', have been prone to pests & diseases which are 'new' to Ireland eg. Citrus Red Mite & Thrips on Prunus, Leaf beetle of Eucalyptus – these pests require an intensive level of monitoring to gain handle on life cycle and occurrence in the Irish climate. The also require intensive work on biological control systems now necessary under IPM and the Sustainable Use Directive.

It is clear that there are a number of major shortcomings with the current system and infrastructure as outlined. These need to be addressed under a different structure going forward if the needs of this fledgling new sector are to be met and the industry can progress and flourish. Options are given and outlined in detail in section 5.1 of this document.

4.0 Priorities for Future R&D

The national cut foliage group suggest that any future Research and Development programme must be directed and led by what is required in the market place. This has driven the success to date and will be pivotal in future work. While this strategy places emphasis on applied research, basic research should also be undertaken utilising the wealth of expertise and facilities of the third level institutes such as UCD, TCD, IT's, Teagasc and the industry. In addition, strong linkages already established with international organisations will also be important in delivering results and technology transfer.

4.1 Priority themes

Three priority thematic areas have been identified:

- Screening, selection & development of innovative new species/foliage using improvement technology
- Development of Agronomy Systems incorporating mechanisation & integrated pest management
- Added Value in foliage product

4.1.1 Screening, selection & development of innovative new species & foliage using improvement technology

A process of evaluation and monitoring over 3-5 years should consist of assessing species for suitability for cut foliage by examining leaf colour, leaf shape, leaf form, scent, volume/ unit area, annual stem length, tree habit, spray formation, susceptibility to weather conditions. A full evaluation of hardiness, pest and disease susceptibility and shelf life aspects needs to be undertaken at the appropriate time; and market response ascertained by involving some of the main cut foliage/flower buyers from UK and Holland. A thorough desk study of all likely candidates should be part of any screening programme and should also include wild and woodland species, given their current importance in the trade.

The development of a wider product range of target species by applying known technological solutions in breeding which has the potential to deliver 'improved' types with more desirable and superior characteristics compared to those currently in the trade will form part of this work programme.

The area of plant propagation and plant biotechnology techniques has a very important role in the future of the foliage development by providing technological solutions to mass produce propagules

from selected superior trees/plants that have high quality characteristics and can give large volumes of foliage among certain species significantly improving the efficiencies and quality in production of foliage crops.

4.1.2 Development of agronomy systems including mechanisation & integrated pest management

Trials work will be initiated to establish grower protocols for field scale production. The trials will fill gaps in information on plant density, weed control, plant pruning regimes, pest and disease issues and nutrition. Testing of species can take place on suitable growers' holdings or trials station (see under section 7). Replicated trials would need to be carried out over a further 2-3 year period, until such time as 'improved' forms with production protocols are suitable for growers to follow, in expanding a particular species in the industry.

With regard to some woodland species, experimental work to ascertain best management practice to allow foliage harvest is required. Aspects of optimum tree density, suitable pruning regime and shelf life assessments should form the bulk of the necessary work programme.

Foliage pruning and harvesting/extraction are currently carried out manually, with little or no usage of modern pruning technology. Manual pruning and harvesting extraction is physically difficult, costly and reduces worker output. There is an urgent need to investigate the potential to mechanise these operations. A work programme to examine different types of pruning machinery and equipment needs to be implemented. Two types of production system are practiced in cut foliage cultivation in Ireland:

1. Extensive low density tree crop production system
2. Intensive high density shrub row system

Once established, crops require annual pruning to a low framework of the trees or shrubs to encourage a flush of new shoots. Pruning machinery/equipment will have to be investigated and adapted to suit this annual pruning /cutting of plant material to fit with the current cultivation systems.

It is important that this machinery operates on a range of soil types and ground conditions in the springtime of each year when this work takes place. The machinery should be capable of pruning crops as low as 40 cm of ground level. Pruning needs to be a clean cut operation so that there is no risk of spread of disease organisms through plantations as a result of poor pruning practice

In regards to harvesting, while currently a costly hand operation, custom built pruning machinery should be investigated that could be adapted to facilitate harvesting of shrubby cut foliage crops. In nursery propagation, custom built machinery is utilised to collect cutting material where it is gathered in 'trailer' like wagons on the back of a tractor. Material is then subsequently hand graded in a processing facility. Similar machinery would greatly facilitate foliage harvesting and reduce costs.

Given the impact of new EU legislation with the introduction of the Sustainable Use Directive (SUD) in January 2014, growers are now obliged to implement programmes for pest and disease control incorporating integrated pest management techniques.

Pests and diseases are still the major cause of quality defects. Given the relative infancy of the cut foliage enterprise, little if any IPM programmes have been developed for such crops. The identification of pest and diseases followed by the development of thresholds in conjunction with monitoring using trapping technologies with the subsequent development of economic & optimum control programmes needs to be expedited.

There are a number of the current foliage species susceptible to damaging pathogens among them for example Cherry Laurel, or *Prunus laurocerasus.* This is a major species grown in the cut foliage business. The foliage market demands blemish free leaves of various shapes, sizes, and colour. 'Shot hole' disease is a very serious threat to the quality of laurel product, which is generally caused by bacteria and fungi. Similar symptoms can also occur due to stress and other issues such as cultivar, site & soil, nutrition etc. Pest damage by caterpillar, capsid, thrip, mite has also been significant in recent years, impacting severely on foliage quality.

While there are recommendations for the use of a suite of pesticides to control these issues, there are increasing restrictions on pesticide use. In addition, for the foliage industry to progress it needs to achieve internationally recognised accreditation, such as Global Gap, and adopt more environmentally friendly IPM strategies under the Sustainable Use Directive (SUD). This will restrict chemical usage for pest and disease control and highlights a need for more information and guidance on how to produce high quality foliage using new approaches to pest and disease control.

4.1.3 Added Value

Trials in adding value to processing product should be accelerated particularly given the installation of glittering & painting facilities in the main processing plant in Kerry. Staying at the cutting edge of the market in the floriculture business means that new products must be delivered to the leading buyers on a regular basis. The development of new foliage products by exploring techniques and

finishes incorporating different colour forms using paints, dyes and scents need to be tested as part of a work programme in the whole are of processing and added value. This is seen as an area with considerable potential in innovation and product development.

4.1.4 Other work programmes

There are a number of other allied projects worthy of research support:

Certification - Certification of forests under the FSC (Forest Stewardship Council) scheme has become more important in recent years with many customers demanding compliance from the timber sector. Indications from the marketplace are that an appropriate certification system will soon be required for non-wood forest products including woodland foliage. To date, foliage products have not been certified under FSC guidelines. Issues such as harvesting levels to ensure sustainability of supply require investigation.

Extraction of aromatic compounds - Scent has been identified as a key factor in the market for forest and other foliages. Many commercially grown forest species possess fragrances that are as yet are unknown in the marketplace; also the oils and extracts of certain woodland plants are known to provide health benefits. As an example, the UK chemist chain Boots have discovered that the oils of the bog myrtle plant possess high antioxidant content and have now developed a range of skincare products containing bog myrtle oil. As well as identifying species with beneficial extracts, from a health and safety point of view, it is also necessary to investigate if any possible toxic substances are produced from foliage plants. This area of work would be longer term in nature compared with other programmes.

5.0 Implementing the R&D Agenda

Implementing the R&D agenda will be a sector wide responsibility with the various stakeholders contributing to the overall R&D effort. It is envisaged that Teagasc will continue to be the main driver of the R&D agenda but supported by Foliage Ireland, the industry and other stakeholders in the sector. The third level colleges will have an important part to play in the provision of basic research, guided by the Research Agenda above, and specialist scientific advice. Growers and the sales and marketing company (FPL) will also provide resources through joint projects, access to crops, benefit in kind or cash contributions.

5.1 Work Programmes

Details of the programme of work that needs to be undertaken in each of the priority areas are presented in Appendix 2.

5.2 Foliage Agronomic Systems Facility

The establishment of a cut foliage agronomic systems facility in collaboration with the Industry aims to develop a centre of excellence for the cut foliage sector and would be one of the key means by which the strategy would be actioned /implemented.

This would be a collaborative 5 year project between Teagasc and Forest Produce Ltd. Teagasc would provide the scientific expertise from existing resources and Forest Produce the local infrastructure as well as making cash contribution or benefit in kind.

The major advantages of such a facility would be to:

- Develop a centre of excellence for the cut foliage sector which would provide the sector with a Research and Demonstration area where a large number of different species and cultural treatments could to be seen, and skilled personnel available for consultation.
- Control over the establishment and subsequent management and maintenance of the plots which is essential to ensure the integrity of the experimental design. There would be a single management structure rather than multiple growers with different approaches.
- Allow the development of skilled labour in the area which is necessary for assessments, application of cultural treatments such as non- standard harvesting techniques etc.
- Provide a training facility for apprentices (potential future growers).
- Have accurate climatic monitoring through installation of automatic weather station on site.
- Facilitate regular insect pest and disease monitoring by a skilled person.
- Facilitate field days as there would be many different trials and observation plots in the same area.
- Reduce the cost of travelling to locations scattered throughout the country.
- Bring credibility to the research programme by being associated with a commercial company which is important in the in the eyes of practitioners.
- Ensure that work is carried out when required rather than leaving it to a grower who may have other pressures and priorities.
- Facilitate the future planning of trials as space will be available over time, obviating the need to search for suitable sites in growers farms.

Requirements

- A rented site 8 ha located in the Tralee area close to the cut foliage processing plant. Established in this area would be:
    - Observation plots – small plots to test the potential adaptability and suitability of species for cut foliage.
    - Replicated trial plots – to gain quantitative data on performance and the effects of cultural treatments.
    - Pilot crops to upscale the planting of species and/or cultural treatments that have proven worthy in the trial plots.

- Researchers
    - Existing foliage researcher in Teagasc would be the Project Leader and have overall responsibility for direction, planning and coordination of the research programme.
    - The research conducted at the facility would primarily focus on practical R&D concentrating on developing protocols for commercial cut foliage production and demonstration to growers. However, the facility would also be available to the third level colleges if appropriate to undertake academic research on some of the topics outlined in the Cut Foliage Strategy. Post doc researchers and students undertaking Masters and PhDs would have access to the facility.
      The facility would also facilitate training of growers and new people that may enter the industry.

- Two qualified graduates, one who would function as a researcher and the other as a worker technician reporting to the Project Manager. The two staff together would be responsible for the:
    - Day to day management of the field trails, organising labour (contractors) on day to day basis as required
    - Acquisition/ propagation of reproductive material
    - Ground prep and laying down trials, fertilisation, weed control, insect pest and diseases etc.
    - Monitoring crop development – and taking action where required
    - Assessing crop parameters growth, yields, damage etc.
    - Maintaining crop records – planting dates, inputs labour, materials, chemical control etc.

- Contactors
    - Ground preparation, planting etc. hired as required
    - Assistance with specialist tasks - analysis and interpretation of data and report writing, again as required.

- Infrastructure
    - The existing infrastructure of Forest Produce Ltd would service the experimental field facility. An office for the researcher and technician should be provided as well as storage space for machinery, materials and equipment.

- Finances
    - Project budget and accounts would be managed by Teagasc.

- Programmes of Work
    - Outline details of programmes of work to be undertaken - Appendix 1

Issues

- Funding - Options include:
    - Observation and trial plots fully funded by research grants as there is risk associated with the trials which a grower should not be expected to bear.
    - Outcome of pilot crops would be more certain so cost of establishment could be borne by Forest Produce Ltd with assistance from the operational programme grant. FP Ltd would take any product harvested.

6.0 Extension

Dissemination of findings is an important aspect of R&D in facilitating the uptake of new ideas, practices etc. Extension has been one of the key priorities of Teagasc to date in supporting growers in the foliage sector, and should continue to be an important aspect of the R&D effort. Outputs from research are valued by the industry and should continue to be disseminated via seminars, crop walks, workshops, technical notes, fact sheets and articles in the trade press.
A cut foliage web site should be developed to promote Irish foliage. Other initiatives would include the formation of a grower's discussion group under the European Innovation Programme.

7.0 Resources & Linkages

7.1 Resources

Manpower - If the foliage sector is to maintain competitiveness in export markets and add value to the rapidly expanding output, the existing research infrastructure must be strengthened. Currently, the low level of research manpower is insufficient to drive the innovation and product development required, and is a key issue that needs to be addressed in the short term. Also, expertise in crop husbandry which is mainly confined to one person could be strengthened. Expanding the number of personnel involved in R&D should therefore be a priority for the sector. Given the programmes outlined above, there is a need for at least 2 full- time people that would be dedicated to progressing the research programme.

Funding - of the research programmes will most likely be a combination of state and private investment. Government programmes such as the DAFM Stimulus Fund, European Innovation Partnership, Horizon 2020 and internal Teagasc research funds amongst others, should be encouraged. Industry support can be via work in kind and financial support sought from the processors. The industry has also indicated their willingness to support the research & development programme.

7.2 Linkages

This strategy aligns with the NRPE's National Research Priority Area I - Sustainable Food Production and Processing, which is focused on 'sustainable, competitive and efficient agri-production, including non-food crops'. NRPE acknowledge that publically funded research is essential to support agriculture, especially in areas of sustainability and environmental impact, such as IPM. The NRPE calls specifically for greater collaboration across research providers. At a national level this strategy will bring together horticulture research, advice and education within Teagasc, in collaboration with third level education providers – UCD, TCD and IT's. The research will forge closer links with HDC (UK) through the memorandum of understanding between the two organisations, which promotes sharing knowledge and joint studentships to avoid duplication. Teagasc also has access to expertise with ADAS (UK), an independent agricultural consultancy and research organisation, again avoiding duplication of activities. The proposed research work specifically addresses sustainable economic development and binding environmental protection requirements under the Sustainable Use Directive (SUD).

Similarly, the Government's Action Plan for Jobs 2014 states that agriculture is one of the strongest performers in job increases over the past few years, providing important development and employment stimulus in rural areas. The sector is being strongly supported by government initiatives to continue this trend; in particular it is prioritizing support to sectors of high potential. The importance of commercial horticulture featured strongly in the DAFM Harvest 2020 policy document. The export market for cut foliage has grown substantially in recent years and the market for is expected to continue to grow, as Irish foliage is recognized as being of very high quality (Burke, Bord Bia 2012). The 'Plan for the Development of the Cut Foliage Sector' produced by the 'Foliage Ireland Group' has set targets in relation to potential job creation as outlined above.

Appendix 1 Programme of Research & Development work on Cut Foliage 2016-2021

Research Work Programme	Tasks
1. Screening & evaluation of plant material	Literature review on species suitable for screening for cut foliage Establishment of small plots of a range of plant material with suitability for cut foliage from existing plants worldwide. Establishment of a programme of work using biotechnology techniques for the production of 'newer' types with suitability for foliage. Physical assessment & Market evaluation of species over 5 year period.
2. Agronomy systems	Establishment of key foliage species in replicated and randomised plots to accommodate trials on aspects of: production systems, weed control, plant density, nutrition, pruning regimes, pest & disease control under IPM, mechanisation of pruning & harvest, post- harvest evaluation. Species to include: Photinia, Erica, Griselinia, Brachyglottis, Hydrangea, Weigela, Cotinus, Sedum, Rose Hips, Rosemary, Conifers, Myrica gale & Betula spp. As new species emerge from the screening process they will enter the agronomy systems programme. Evaluation of techniques in used for mass propagation of evergreen species in commercial horticulture to provide technological solutions to mass propagate plants from selected plants. Eg core species such as Eucalyptus etc.
3. Adding Value to foliage species	Experimental work on a range of cut foliage species to evaluate a range of techniques using additives such as dyes, paints, scents, textured substances.

Appendix 2 Budget & Costs for Foliage Agronomic Systems Facility

The primary costs in the first 3 years are summarised in the following table. Staff cost cover a researcher and a technician. 'Miscellaneous' covers items of materials & equipment - plot sprayer, computer equipment etc. necessary to carry out trial work. A 7 year full cash flow budget is also shown. The figures show that the where one third of the stems are sold for foliage (the remainder damaged or unsuitable as a result of the trials work) that the unit breaks even in the fourth year and can be self- financing thereafter.

	Trials Facility	**Staff ***	**Consultants & miscl.**	**Total**
Year 1	€185,360	€80,000	€25,000	€290,360
Year 2		€80,000	€25,000	€105,000
Year 3		€80,000	25,000	€105,000
Total	€185,360	€240,000	€75,000	**€500,360**

*1 researcher & 1 worker technician

7 Yr Cash Flow projection for 20 acre unit cut foliage

Area	20	Acres	
rent	€250.00	per annum	
Maintenance	€350.00	per annum	
Price per stem	2	cents per stem	
**Yield (stems/acre) increase / decrease*	66% decrease		

*two thirds wastage due to damaged stems as result of research use 33%

		cost/ac	Production	stems/tree	stems/ac
Establish cost		9268	Yr 1	0	0
Total no. acres		20	Yr 2	0	0
Trees/Plants	12000	240000	Yr 3	0	0
			Yr 4	8	1920000
			Yr 5+	12	2880000

Ground preparation costs

Item	**Cost/ac**
Sub soiling	38
Burn off	12
Spraying	12
Plough	28
Disc	14
Rotovate	40
Ridge	50
Dish Drain	40
Fertiliser compound	124
Fertiliser spreading	8
Fabric	1500
Laying weed fabric	500
Plants 12k @50 ct	6000
Planting	400
Rabbit fencing	500
Total cost per acre	**9268**

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Stems Sold			*0*	*1,920,000*	*2,880,000*	*2,880,000*	*2,880,000*
Stems Sold			*0*	*633,600*	*950,400*	*950,400*	*950,400*
Yield		*0*	*0*	*4,181,760*	*6,272,640*	*6,272,640*	*6,272,640*
Income		€0.00	€0.00	€253,440.00	€380,160.00	€380,160.00	€380,160.00
rent		€5,000.00	€5,000.00	€5,000.00	€5,000.00	€5,000.00	€5,000.00
Maintenance		€7,000.00	€7,000.00	€7,000.00	€7,000.00	€7,000.00	€7,000.00
Net Profit		-€12,000.00	-€12,000.00	€241,440.00	€368,160.00	€368,160.00	€368,160.00
Cumulative		-€197,360.00	-€209,360.00	€32,080.00	€400,240.00	€768,400.00	€1,136,560.00
Establishment cost	**€185,360.00**						

References

Burke, R. (2012) Research on the foliage Industry: The Netherlands, Uk & Ireland. Bord Bia.

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