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Project Title: New Leaves

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Programme: Crops, Environment and Land Use Programme

Department: Horticulture

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Information

Scientific Abstract

This project aims to identify and develop a number of alternative /novel crops to feed into the cut foliage and nursery stock sectors in Ireland in response to demand from export and home markets that cannot be satisfied at present. More productive lines of Eucalyptus spp. with high rooting capacities will be identified and propagation technology will be developed to produce these plants. In addition, field trials will be set up screening novel material of Pittosporum, Viburnum, Ozothamnus, Brachyglottis, Hebe and Eucalyptus spp. In addition, to propagating and evaluating cultivars we propose to induce polyploids of Viburnum and Brachyglottis to generate novel material for foliage production i.e. more vigorous plants with thicker leaves and a reduced capacity for flowering.

In addition to screening and creating new novel crop lines, we also propose to study the epidemiology of Pseudomonas syringae and pest species on Prunus laurocerasus when grown as a cut foliage crop. Pests and pathogens are emerging as a major concern for the industry. They seem to be responding to unique cultural conditions associated with cut foliage production, which may influence growth and development, when compared to Prunus grown as a hedging plant for the nursery stock trade.

Rationale for undertaking the research

Provide background information on why the research was needed; the problem/knowledge gap addressed; and the target end-user audience. (max 250 words)

Cut Foliage is a new emerging industry, suiting the mild Irish climate. The export market has grown substantially in recent years as Irish foliage is recognized as a high quality product. The Foliage Ireland Group led by Teagasc, are confident that the Cut Foliage sector will contribute to FoodWise 2025 targets of increasing horticultural output by 25%, producing foliage valued in excess of €20 million and generating 400 full-time jobs equivalent in rural Ireland by that time.

The market value for cut flowers and fresh foliage was €16 billion in 2009 and annual foliage consumption was €549m. Worldwide, this sector has been growing rapidly at 7- 8% p.a. There is a clear potential to increase Irish production, Irish exports as well as import substitution.

Eucalyptus, Pittosporum, and Viburnum are important plant species in the foliage/filler market today. Other species become important, for novelty purposes (scent, berries, new colours & textures) such as Hebe, Ozothamnus and Brachyglottis. These market demands underpin the selection of novel species which are the focus of this proposal.

The foliage market demands high quality, blemish-free leaves. Thus, there is a need to elucidate the incidence and distribution of pathogens and pests. Epidemiological information on the major pests (tortrix moth, capsid bug and thrips) and pathogens (*Pseudomonas syringae* causing Shothole disease) is needed to improve targeting control measures more effectively.

Increasingly, under the Sustainable Use Directive (SUD) all producers must adopt IPM strategies to tackle pest and disease issues. This project will provide data to underpin IPM.

Research approach

Outline how the research was carried out and the research methodologies used, noting any scientific or technical difficulties encountered in the research. (max 250 words)

The project was divided into five main Tasks. Task 1 focused on Eucalyptus. This task evaluated 15 species of Eucalyptus for their potential as new cut-foliage species for the sector. Seed germination-characteristics were described, vegetation propagation potential was evaluated, seeds were irradiated to generate novel mutations and micropropagation methods were explored.

Task 2 focused on the development of micropropagation protocols to facilitate developing novel polyploid lines of important species in cut foliage production. Micropropagation protocols were developed for *Viburnum tinus*, *Pittosporum tenuifolium*, *Brachyglottis greyi* and a *Hebe speciosa* clone, and micropropagated plants were then used in polyploidy experiments.

Task 3 surveyed cut foliage plantations and nurseries of Cherry Laurel for shothole disease and other pathogens over the course of the project. Bacterial and fungal pathogens were identified using microbiological and molecular techniques. A trial of biostimulant and biocontrol products was undertaken at a Cherry Laurel plantation in Kerry and compared with standard chemical control products for control of shothole disease.

Task 4 studied the epidemiology of shothole disease on *Prunus laurocerasis* in the laboratory, glasshouse and outside locations, looking at the effects of wounding, temperature, shading and humidity on disease expression.

Task 5 characterised the occurrence and growth characteristics of three pests of *Prunus laurocerasis*: tortrix moth, green capsid bug and thrips, over the growing season, using passive and active monitoring techniques. Laboratory and glasshouse growth trials for each pest were also conducted. A review of commercially available plant protection products was done to identify application-timings to achieve optimal results

Research achievements and results

Outline the results of the research, with emphasis on novelty and innovation. (max 300 words)

Fifteen species of Eucalyptus were evaluated as potential cut-foliage species. Germination characteristics were established and three specimens of each were planted in the Teagasc Kildalton Cut Foliage Plantation. Trials determined that all were difficult to propagate vegetatively. A micropropagation protocol was developed and shows promise for propagating elite individuals. Irradiated Eucalyptus seed produced several unique individuals, which are currently maintained by Teagasc.

Micropropagation protocols were developed for *Viburnum tinus*, *Pittosporum tenuifolium*, *Brachyglottis greyi* and *Hebe speciosa* in preparation for polyploidy experiments. Novel Hebe polyploid mother plants were produced with excellent cut-foliage characteristics, having larger, more abundant leaves per stem and reduced flowering. They are maintained at Teagasc. Polyploidy experiments with other species were unsuccessful.

The bacterium *Pseudomonas syringae* pv *syringae*, which causes Shothole disease of *Prunus laurocerasus*, was the dominant pathogen on all commercial sites surveyed. A crop walkers guide to pathogens and pests of *Prunus laurocerasus* is now available. A trial of commercial products, plant stimulants and biological control agents, showed all reduced shothole disease compared to untreated controls (larger scale trials are needed), offering the possibility to enhance the environmental-sustainability.

Conditions which lead to increased shothole disease on *Prunus laurocerasus* were established, and include exposed sites, mild temperatures and wounding. Some cultivars are more susceptible to the disease such as *Rotundifolia*, *Novita* and *Etna*. Humidity did not promote symptoms in leaves which were already infected.

Active and passive field monitoring of the key insect pests: tortrix moth, green capsid and thrips in 2017-2019 indicated a high level of variability, making predicting pest occurrence very difficult. Monitoring the damage to foliage informed a preventative management strategy for each of the key pests. Laboratory-based trails indicated that most key pests require alternative host plants to sustain a population. A review of commercially available pesticides identified appropriate application-timings to achieve optimal results.

Impact of the research

Summarize the impact of the research project outlining the benefits/improvements the research has made to the area under investigation. Describe how the outcome of the research have benefited the end users such as industry, consumers, regulatory authorities, policy makers and the scientific community. (max 300 words)

The project had an impact on research links and industry links. Research links with UCD in the area of cut foliage pest and disease research have been strengthened through this project and students are now exposed to more information on cut foliage pests and diseases through the participation of two lecturers on the project. Contact with Waterford IT has been advanced. Level 8 students engaged with the New Leaves technician at Teagasc Kildalton for final year project work. Preliminary contact has been made with the newly launched Munster Technological University (MTU) with a view to encouraging Cut-foliage research via Teagasc Walsh Scholarship projects

The research has strengthened the links with the company Forest Produce, a cut-foliage company who supported and collaborated on this project. While discussions on new research projects have occurred, none have been progressed to proposal stage, as funds are scarce and our proposed research is still seen as requiring further development before industry could support it with funding. Teagasc's cut foliage specialist, Andy Whelton, is an advisor to a new cut foliage company - Tanners Foliage in Lusk, Co. Dublin. They are expanding and growing Eucalyptus species for cut foliage. They should be important collaborative partners in the future.

A Eucalyptus nursery in UK, Grafton Nursery, Worcestershire, are interested in our research and attended the Eucalyptus day event held in 2019 at Kildalton. They could be potential partners in funding proposals involving UK organisations such as AHDB (Agriculture and Horticulture Development Board) who fund research for the sector in the UK.

Adam Parsons, a Eucalyptus specialist in Australia is interested in our work and keeps in contact with Andy Whelton.

Similarly 'Irish Green Guys', a new online company selling foliage, and Coillte, who grow eucalyptus for biomass, keep in touch regarding research outputs.

Practical Implications for Stakeholders

Identify the problem the knowledge/technology will solve for the potential end-user. Specify the end-users and the main benefits if adopted. (max 250 words)

A new unique polyploid Hebe clone was developed that has interesting attributes for the cut foliage sector. However, further development and post-harvest shelf life research is needed to determine suitability and appeal to stakeholders at a commercial scale.

Similarly, a number of unique Eucalyptus clones with interesting characteristics were developed from irradiation experiments. However, further development research is needed to determine if they can be grown and propagated successfully and if they have appeal to stakeholders at a commercial scale.

If these clones are determined to be of interest then they will need to be protected by plant breeders rights, and a licencing agreement reached with potential commercial propagators of the material. However, IP protection (plant breeders rights) will not be sought until the material can be validated as of commercial interest, which requires further research. However, there are limited avenues for research funding to conduct such work.

New micropropagation methods have been developed for a number of species of interest to cut foliage. Of especial interest is the the micropropagation protocol for hard-to-propagate material of Eucalyptus. This could be of interest to specialist Eucalyptus nurseries and micropropagation companies.

Micropropagation protocols have also been developed for Viburnum tinus, Brachyglottis greyi and Pittosporum tenuifolium and the protocol for Hebe speciosa has been improved. This will benefit the scientific community and will facilitate further research to generate novel varieties of these species (by polyploidy and irradiation), and the bulking up of unique individuals for hard-to-propagate material.

Future strategies

Future strategies to further develop the research should be indicated. If the outputs of the research have not been taken up by end users, explain why this is the case. What further advances / work is required in your area of research in order for the outputs to taken up by industry / consumers / end users? What follow-on research is required in this area to realise an end product? If further funding is required for research in this area, where do you intend to apply for funding e.g. Enterprise Ireland? (max 300 words)

As outlined above, this research has made several excellent advances in cut-foliage research that supports the future development and expansion of the sector. There is very limited work in this area and, as a result, this research has made a major contribution, developing new plant clones with unique traits and new micropropagation protocols of direct relevance to the future of the sector. The project team has explored avenues for future research funding both nationally and with stakeholder companies but without success. The opinion of the commercial sector is that further research is still needed to validate potential novel plant clones to demonstrate that they have good potential at a commercial level. At that point, the commercial sector could be willing to contribute towards research that gets the products to market. In the meantime the PI continues to search for potential research funding opportunities.

Was there any potential IP arising from this project?

(e.g. Invention Disclosures, patents, know-how, software, databases, data sets, plant variety rights, strains, etc.)

No

Has there been any interaction with interested industry parties in this project?

Yes

Submitted Outputs List

This is a list of all submitted outputs from this project. This list will be displayed on the submitted report.

Output Type	Status	Title	Citation
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