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## Section 1 - Overview of Period under Review

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### Project Summary

| Reporting Period No. | From             | To               |
|----------------------|------------------|------------------|
| 4                    | 01 December 2019 | 31 December 2020 |

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### Project Dates

| Project Start Date as per Contract | Actual Start Date |
|------------------------------------|-------------------|
| 01 December 2016                   | 01 December 2016  |

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| Project Completion Date as per Contract | Approved Revised Completion Date |
|---|----------------------------------|
| 30 November 2019                        | 31 December 2020                 |

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### Research Institutions Expenditure

| Name of Institution                      | Expenditure in this Period (€) |
|--|--------------------------------|
| Teagasc Ashtown                          | €103,143.05                    |
| University College Dublin                | €13,259.29                     |
| <i>No Response</i>                       | €0.00                          |
| <i>No Response</i>                       | €0.00                          |
| <i>No Response</i>                       | €0.00                          |
| <i>No Response</i>                       | €0.00                          |
| <b>Overall Total for this period (€)</b> | <b>€</b><br>116,402.34         |

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### Deferred / Outstanding Queries as a result of the last PPR

Were all outstanding / deferred queries from the previous progress report addressed? If so, briefly summarize actions taken to address any outstanding / deferred queries?

All queries were addresses

### Task Status

| No. | Title  | Status    |
|-----|--|-----------|
| 1   | Surveying / screening existing plantations and seed batches of novel Eucalyptus spp. and lines of Hebe for highly productive individual with superior foliage and efficiency traits and developing systems for their vegetative propagation. | Completed |

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|   |  |                    |
|---|--|--------------------|
| 2 | Development of micropropagation technologies for novel foliage material of Pittosporum, Viburnum, and Ozothamnus and the production of polyploidy lines of Viburnum tinus 'Purpureum' and Brachyglottis greyi. | Completed          |
| 3 | Survey of cut foliage plantations for incidence and occurrence of Pseudomonas syringae pv syringae and Xanthomonas arboricola pv. Pruni  | Completed          |
| 4 | Epidemiology of Pseudomonas psyringae pv syringae on Prunus laurocerasus   | Completed          |
| 5 | Epidemiology of foliage pest invertebrates on Prunus laurocerasus and efficacy of pest control using foliage management practices and Plant Protection Products  | Completed          |
| 0 | <i>No Response</i>   | <i>No Response</i> |

## Project Summary

Fifteen species of Eucalyptus were evaluated for their potential as cut-foliage species, to augment the resources available to the sector. Germination characteristics were established and three specimens of each species were planted out in the Teagasc Kildalton Cut Foliage Plantation. Trials determined that most Eucalyptus species grew well as 'hedge-plants' and tolerated coppicing well however all were difficult to propagate vegetatively by cuttings. A micropropagation protocol was developed and may be the most appropriate method for propagating elite individuals. Batches of Eucalyptus seed were irradiated and sown and some unique individuals developed (i.e. dwarf/taller/bushier varieties, novel leaf shapes and stems). These unique 'mother-plants' are currently maintained by Teagasc.

Micropropagation is an important technique used in polyploidy experiments, which seek to develop new plants with interesting characteristics. 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 compared to existing varieties, having larger, more abundant leaves per stem and reduced flowering. They are being maintained at Teagasc. Polyploidy experiments with Viburnum tinus and Brachyglottis greyi were unsuccessful.

Shothole disease of Prunus laurocerasus is a serious problem in cut-foliage plantations and plant nurseries. The bacterium Pseudomonas syringae pv syringae was found to be the dominant pathogen on all commercial sites visited and a new bacterial pathogen of cherry laurel, Micrococcus aloverae, was identified. A crop walkers guide to the pathogens and pests of Prunus laurocerasus has been produced and is available to the sector.

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

A number of commercial products, including plant stimulants and biological control agents, were evaluated for their impact on shothole disease expression. The results indicated that all products significantly reduced shothole incidence compared to the untreated control. Larger scale trials, replicated across different sites, are needed. Such products offer the possibility to reduce reliance on chemical pesticides and would enhance the environmental sustainability of the sector. Intensive field monitoring in 2017 characterized the growth-habits of two Cherry Laurel cultivars, 'Etna' and 'caucasica', in commercial plantations, which determined the growth-phases susceptible to the key insect pests: tortrix moth, green capsid and thrips. Active and passive field monitoring in 2017-2019 indicated a high level of variability, making predicting pest occurrence very difficult. Monitoring the damage to foliage enabled identification of the species and the timing of their incidence, informing a preventative management strategy for each of the key pests. Laboratory-based trials indicated that most of the key pests require alternative host plants to sustain a population, highlighting the importance of other plant species growing in commercial plantations. In a review of commercially available pesticides, those targeting key pest species were highlighted and their timing of use to achieve optimal results were identified.

## Queries

| DAFM query         | Coordinator response | DAFM Query Status  | DAFM outcome       |
|--------------------|----------------------|--------------------|--------------------|
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |

## Section 2 - Progress and results achieved on Task 1

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### Summary of Progress & Outcomes

| Task No                | Task Title   |
|------------------------|--|
| 1                      | Surveying / screening existing plantations and seed batches of novel Eucalyptus spp. and lines of Hebe for highly productive individual with superior foliage and efficiency traits and developing systems for their vegetative propagation. |
| <b>Start date</b>      | 01 December 2016   |
| <b>Completion date</b> | 31 December 2020   |

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### Milestone Progress

| MS no | MS title  | Status    | Summary of progress  |
|-------|---|-----------|--|
| 1.1   | All selections of high yielding Eucalyptus plants marked in plantations | Completed | See PPR1   |
| 1.2   | 'New' seed selections sourced, sown and planted out in trial locations  | Completed | See PPR2   |
| 1.3   | Successful germination of seeds from irradiated Eucalyptus plants       | Completed | See PPR3.  |
| 1.4   | First successful rooting achieved for selections of Eucalyptus and Hebe | Completed | See PPR2   |
| 1.5   | Optimal time period(s) for taking Eucalyptus cuttings identified.       | Completed | PPR4. A third Eucalyptus cuttings trial was undertaken, June 2020. Fifty cuttings per species were taken, treated with rooting hormone powder and placed in a moist cuttings compost, and incubated under polythene on a misting bench. Rooting of cuttings was assessed after 4-8 weeks. The results were again variable and inconsistent and with poor results overall. As in previous trials, The % of cuttings rooting successfully did not go above 30%, which is a very poor success rate. Ideally 80% success is desirable for vegetative propagation to be a useful propagation method. It was not possible to identify an optimum time to take Eucalyptus cuttings for successful vegetative propagation. |

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|     |  |           |   |
|-----|--|-----------|---|
| 1.6 | Rooting achieved in stump sprouts of three Eucalyptus species. | Completed | PPR4. Progress with this milestone was delayed due to COVID 19 and the early resignation in April 2020 of the technician employed on the project. None the less, a final rooting experiment was completed but rooting of all species was still very poor, as outlined at M1.5 above and successful rooting of cuttings from coppiced stump sprouts was not achieved. In view of these disappointing results, micropropagation would seem to be the most suitable method to be used to propagate new Eucalyptus plants from high performing individuals. |
|-----|--|-----------|---|

## Summary of Deliverable Status

| Deliverable title   | Deliverable status |
|---|--------------------|
| 1. Report on the frequency, morphological characteristics and productivity of high yielding Eucalyptus individuals within three species in Irish plantations & germination of potentially 'new' seed raised species | Completed          |
| 2. Identification and production of high yielding plants with a high capacity for rooting of cuttings of Eucalyptus and of stable novel variants of Hebe  | Completed          |
| 3. Report and scientific paper on the foliage potential of Eucalyptus (from irradiation and in polyploids) based on their stability and growth performance and rooting capacity                                     | Completed          |
| 4. Report & scientific paper on the influences of cutting sources, rooting treatments and genotype affecting rooting in 3 species of Eucalypt   | Completed          |
| 5. Stocks of mother plants of Hebe propagated from novel selections within seedlings derived from irradiated plants and also among polyploids   | Completed          |
| 6. Stocks of mother plants from three species Eucalyptus, with high rooting capacity, propagated from novel selections  | Incomplete         |
| 7. Final Report   | Completed          |

## Issues Encountered

M1.6. Work on progressing the rooting trials in 2020 was severely impacted and delayed. In addition to restrictions due to COVID 19, the technician working on the project resigned on 30/04/2020 before the end of his contract on 15/07/2020, thereby leaving the project team short on technical support at a crucial time for the rooting trials. As the technician was based in Teagasc Kildalton, all the New Leaves plant material had to be transported from Kildalton to Teagasc Ashtown, where Teagasc staff took over looking after them. With the help of Teagasc staff, a final rooting experiment was set up in the week June 29th, 6 weeks later than the planned date in mid-May. Despite using a state of the art misting unit at Teagasc Ashtown, rooting of cuttings was still very poor for all species examined and therefore vegetative propagation is not considered to be a viable option for the propagation of high value elite clones of Eucalyptus species for cut foliage. Propagation of Eucalyptus is therefore likely to require the use of micropropagation techniques (successfully developed in Task 2) to bulk up plant numbers of specific individuals with desirable traits.

D1.4. Report & scientific paper on the influences of cutting sources, rooting treatments and genotype affecting rooting in 3 species of Eucalyptus. Due to the poor success and variability of the results over three trials we believe it does not warrant a scientific paper. However, the results are none the less interesting and informative and we plan to include it in some form in a scientific paper on the micropropagation of Eucalyptus. The information will also be summarised and disseminated to the stakeholders as part of a Eucalyptus propagation factsheet.

D1.6. Stocks of mother plants from three species Eucalyptus, with high rooting capacity, propagated from novel selections.


As the rooting work was so unsuccessful, this deliverable cannot be achieved. Further work would be required to evaluate using micropropagation as a means of bulking up stocks of Eucalyptus mother plants.


D1.7. Final Report. The DAFM Final report will not be requested by DAFM until PPR4 is completed and accepted. A final report is being prepared for the Stakeholders. Due to Covid 19, and delays in completing Tasks 1 and 2, the Stakeholder meeting has been delayed to late 2021. The PPR4 report was also delayed due to knock on effects of COVID 19 on work progress. Requests for an extension to the reporting deadline were requested from the Project Officer , which was granted.

#### Please upload any Supplementary Charts, Tables etc..

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 [New Leaves Task 1 Pictorial](#)

 01/06/2021

 19:32:17

 pdf 1.28 MB

#### Queries

| DAFM query  | Coordinator response | DAFM Query Status | DAFM outcome |
|-------------|----------------------|-------------------|--------------|
| No Response | No Response          | No Response       | No Response  |
| No Response | No Response          | No Response       | No Response  |

#### Is this task complete?

Yes

#### Task completion date

31 December 2020

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#### Summary of Task Outcomes

This task evaluated 15 species of Eucalyptus for their potential as cut-foliage species, to augment the resources available to the sector. Seed germination-characteristics were described and established that none of the species tested required a cold (stratification) period to germinate. Eleven species germinated well, with medium to high vigour. Three specimens of each species were planted out in the Teagasc Kildalton Cut Foliage Plantation as a resource for the sector. Three trials were done to determine the capacity of Eucalyptus species to grow as hedge-plants, and tolerate regular coppicing, a requirement for vegetative propagation. Most species tolerated coppicing well and produced numerous single and/or spray stems in the following growing season. Results from the vegetative propagation trials were poor and variable, leading to the conclusion that vegetative propagation is not a realistic option for these species. A micropropagation protocol was developed for four species of Eucalyptus including E. parvula, E. cinerea, E. glaucescens and E. subcrenulata.

Batches of Eucalyptus seed (Eucalyptus parvula, E. cinerea, E. glaucescens and E. subcrenulata) were irradiated to create individuals with potentially interesting characteristics. A number of dwarf varieties, taller/bushier varieties, and varieties with novel leaf shapes developed. These unique 'mother-plants' will be maintained at Teagasc.

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### **Describe how these outcomes may be relevant to end users such as Industry, Policy makers, Farmers or Practitioners.**

The outcomes of this task on increasing the Eucalyptus resources for the cut foliage sector are summarised in a peer reviewed publication on a comparative study of 15 Eucalyptus species, an Industry factsheet on Eucalyptus propagation, a Eucalyptus species plot in the Cut Foliage plantation area at Teagasc Kildaton and novel unique 'mother plants' derived from mutagenesis following the irradiation of seed. These materials are available to a variety of stakeholders including cut foliage growers, hardy nursery stock growers, the forestry sector, commercial foliage buyers, the horticulture education community, the scientific community. The work underpins small businesses and employment in rural areas in a growing area of horticulture, that is export focused. Foliage plantations support biodiversity and provide food and shelter for a variety of birds and insects thereby helping to support and sustain local wildlife.

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### **Describe how it has added to the research base (skills, leveraging of funding, infrastructure capabilities etc.)**

This is the first major research project to support the fledgling Cut-Foliage sector in Ireland. This work has helped to train and advance the skills and experience of a Post Doctoral researcher and two horticulture technicians, all of whom have gone on to obtain employment in Ireland in their areas of expertise. During the project three undergraduates spent 6-12 weeks each helping out on the project, gaining valuable experience as part of their science studies. The work has leveraged considerable interest from the commercial foliage community across Europe and project personnel have spoken at several meetings with buyers and researchers. The Eucalyptus species plot at the cut foliage plantation at Teagasc, Kildaton is a great showcase of the work done and a resource for the future. The research has identified a number of avenues that would benefit from future research and draft project proposals are being prepared. Teagasc has enhanced its capacity for cut-foliage research, in terms of know-how and plant resources.

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## **Section 3 - Progress and results achieved on Task 2**

### **Do you require a second task?**

Yes

### **Summary of progress**

| <b>Task No.</b>        | <b>Task Title</b>   |
|------------------------|---|
| 2                      | Development of micropropagation technologies for novel foliage material of Pittosporum, Viburnum, and Ozothamnus the production of polyploid lines of Viburnum tinus 'Purpureum' and Brachyglottis greyi. |
| <b>Start date</b>      | 01 November 2016  |
| <b>Completion date</b> | 31 December 2020  |

### **Milestone Progress**

| <b>MS no</b> | <b>MS title</b>   | <b>Status</b> | <b><u>Summary of progress</u></b> |
|--------------|---|---------------|-----------------------------------|
| 2.1          | Rooting and weaning of 200 plants of V. tinus 'Purpureum' | Completed     | See PPR3                          |

|             |   |             |   |
|-------------|---|-------------|---|
| 2.2         | Successful initiation of sterile buds in culture of <i>Pittosporum tenuifolium</i> 'Purpureum', <i>Viburnum cinnamomifolium</i> , <i>Brachyglottis greyi</i> and <i>Ozothamnus</i> 'Sussex Silver' and 'Silver Jubilee' (and hybrids) | Completed   | All work completed - micropropagation protocols for all four species: <i>Viburnum tinus</i> , <i>Pittosporum tenuifolium</i> , <i>Brachyglottis greyii</i> and <i>Hebe</i> , are now in place and manuscripts for publication are being prepared.   |
| 2.3         | Proliferating shoot producing cultures are well established for all of the selected foliage material specified above  | Completed   | See PPR2  |
| 2.4         | Successful rooting and weaning achieved for <i>Pittosporum</i> , <i>Viburnum</i> , <i>Brachyglottis</i> and <i>Ozothamnus</i> material  | Completed   | All work completed - micropropagation protocols for all four species: <i>Viburnum tinus</i> , <i>Pittosporum tenuifolium</i> , <i>Brachyglottis greyii</i> and <i>Hebe</i> , are now in place and manuscripts for publication are being prepared. Micropropagated plants of <i>Viburnum</i> and <i>Brachyglottis</i> have been potted up and grown in the glasshouse and will be transferred to the nursery in 2021. <i>Hebe</i> polyploids have also been produced and potted up in the glasshouse and will be transferred to the nursery in 2021. (See uploaded pictorial pdf of Task 2) These novel plant materials will be available to the sector in the form of a demonstration plot at either Teagasc Ashtown or Teagasc Kildalton (discussions are currently underway to identify the best location for this material). |
| No Response | No Response   | No Response | No Response   |
| No Response | No Response   | No Response | No Response   |

### Summary of Deliverable Status

| Deliverable title   | Deliverable status |
|---|--------------------|
| 1. Viable shoot producing cultures established for <i>Pittosporum</i> , <i>Viburnum</i> and <i>Brachyglottis</i>  | Completed          |
| 2. Some weaned plants of the selections transferred to the nursery  | Completed          |
| 3. Report & scientific paper on the effects of various concentrations and type of chemicals for inducing polyploidy in shoot cultures of <i>Viburnum tinus</i> and <i>Brachyglottis</i> | Completed          |
| 4.. Report & scientific papers on the methodology for micropropagating all of the target species  | Completed          |
| 5. Novel polyploidy plants produced of <i>Viburnum tinus</i> 'Purpureum' and <i>Brachyglottis greyi</i>   | Completed          |

6. Stocks of mother plants of Pittosporum tenuifolium 'Purpureum', Viburnum cinnamomifolium, Viburnum tinus 'Purpureum', Brachyglottis greyi and Ozothamnus made available to commercial propagators

Completed

7. Final report

Not started


### Issues Encountered


Issues Encountered:


As reported in PPR3, work to deliver M2.1 milestone was only partially completed due to poor results with polyploidy work on Viburnum and Brachyglottis due to sensitivity of the tissues to the chemicals used. Production of polyploids for Viburnum and Brachyglottis was thus not achieved. This affects deliverables D2.5 and D2.5 which are effectively 'Incomplete' for the species listed. However, work was then focussed on completing the micropropagation protocols for Viburnum tinus, Brachyglottis greyi and conducting polyploidy work on Hebe, which was successful. For the purposes of this project these deliverables are now marked as complete.

### Please upload any supporting documents (Tables, images, graphs etc.)

 [New Leaves Task 2 Pictorial](#)

 01/06/2021

 19:35:33

 pdf 1.15 MB

### Queries

| DAFM query  | Coordinator response | DAFM Query Status | DAFM outcome |
|-------------|----------------------|-------------------|--------------|
| No Response | No Response          | No Response       | No Response  |
| No Response | No Response          | No Response       | No Response  |

### Is this task complete?

Yes

### Task completion date

31 December 2020



## Summary of Task Outcomes

This task was concerned with the development of micropropagation protocols as well as developing polyploid lines of a number of plant species important for cut foliage production. Micropropagation is an important technique for two reasons: (1) micropropagation is needed to bulk up sterile plantlets of a particular plant variety for use in polyploidy experiments and (2) micropropagation may be the most effective or only way to propagate species that are hard to propagate by normal vegetative propagation techniques. Vegetative propagation is used to bulk up novel unique varieties of a species, and is commonly used on plant nurseries.

In this task, micropropagation protocols were developed for *Viburnum tinus*, *Pittosporum tenuifolium*, *Brachyglottis greyi* and a *Hebe speciosa* clone in preparation for polyploidy experiments. All produced plantlets with good shoot and root development that were potted up and grown in the nursery (except *Pittosporum*). This means that a technique is now in place to bulk up sterile plantlets for polyploidy or other genetic manipulation experiments to develop new varieties. In addition, the micropropagation method can be used to bulk up numbers of difficult-to-propagate elite individuals. Peer review publications are in progress to describe these protocols for the scientific community.

A small stock of novel *Hebe* polyploid mother plants has been produced. They have excellent characteristics for cut foliage production compared to existing varieties: they are slightly shorter, with larger and more abundant leaves per stem and with reduced flowering. They are being maintained at Teagasc pending future development and evaluation for the cut foliage sector. Polyploidy experiments with *Viburnum tinus* and *Brachyglottis greyi* were unsuccessful.

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### **Describe how these outcomes may be relevant to end users such as Industry, Policy makers, Farmers or Practitioners.**

Micropropagation is a highly skilled laboratory procedure that is used widely in Horticulture and plant science for difficult-to-propagate species and rare individuals. However the requirements for each species are different and so micropropagation protocols have to be tailored to each individual species. The Plant Science community and plant micropropagation businesses are potential end users of this information. In addition, if elite clones of these species are identified among the existing cut foliage plantations then growers could commission work to bulk up the numbers by micropropagation. As this technology is in its early stages with regards to cut foliage, additional research support is likely to be needed to take such work to a stage where the industry embrace it with confidence. Ultimately a commercial micropropagation company would become involved.

Novel *Hebe* polyploids have been developed during this task that have excellent characteristics for cut foliage production. Compared to existing varieties, they are shorter, bushier, have thicker stems, leaves are larger and more abundant per stem and plants have reduced flowering. Further research funding is needed to take these to a demonstration and evaluation phase to see if they perform well in the field and also with consumers. As this type of research is very novel for the cut foliage sector, additional research support is likely to be needed to take such work to a stage where the industry embrace it with confidence and are encouraged to invest in research activities.

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### **Describe how it has added to the research base (skills, leveraging of funding, infrastructure capabilities etc.)**

This is the first major research project to support the fledgling Cut-Foliage sector in Ireland. This work has helped to train and advance the skills and experience of a Post Doctoral researcher and two horticulture technicians, all of whom have gone on to obtain employment in Ireland in their areas of expertise. During the project three undergraduates spent 6-12 weeks each helping out on the project, gaining valuable experience as part of their science studies. The work has leveraged considerable interest from the commercial foliage community across Europe and project personnel have spoken at several meetings with buyers and researchers. The Cut Foliage species plot at Teagasc, Kildalton is a great showcase of the work being done to identify novel material for the sector. It is envisaged that plant material from this task will be planted out either at Kildalton or at Ashtown (currently under discussion), where it will be a resource for the future. The research has identified a number of avenues that would benefit from future research and draft project proposals are being prepared. Teagasc has greatly enhanced its capacity for cut-foliage research, in terms of know-how and plant resources.

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## Section 4 - Progress and results achieved on Task 3

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### Do you require a third task?

Yes

### Summary of Progress & Outcomes

|                   |   |
|-------------------|---|
| <b>Task No.</b>   | <b>Task Title</b>   |
| 3                 | Survey of cut foliage plantations for incidence and occurrence of <i>Pseudomonas syringae</i> pv <i>syringae</i> and <i>Xanthomonas arboricola</i> pv. <i>pruni</i> |
| <b>Start Date</b> | <b>Completion Date</b>  |
| 01 December 2016  | 31 December 2020  |

### Milestone Progress

| MS no              | MS title   | Status             | Summary of progress   |
|--------------------|--|--------------------|---|
| 3.1                | First set of bacterial and fungal pathogens of <i>Prunus laurocerasus</i> isolated and characterized from Irish cut foliage plantations and nurseries and methods established for their identification | Completed          | completed in PPR1   |
| 3.2                | Full list of bacterial and fungal pathogens of <i>prunus laurocerasus</i> isolated and characterised from Irish cut foliage plantations and nurseries  | Completed          | Completed in PPR2   |
| 3.3                | Survey work completed  | Completed          | completed in PPR3. KT outputs from the work were prepared in this period and reported elsewhere |
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i>  |
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i>  |
| 0                  | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i>  |

### Summary of Deliverable Status

| Deliverable title   | Deliverable status |
|---|--------------------|
| D3.1 Technical report on incidence and characterization of bacterial and fungal pathogens of <i>Prunus laurocerasus</i> in cut foliage plantations and nurseries. | Completed          |
| D3.2 Technical report on the effects of various abiotic factors and crop management practices on disease incidence on <i>Prunus laurocerasus</i> .                | Completed          |
| <i>No Response</i>  | <i>No Response</i> |
| <i>No Response</i>  | <i>No Response</i> |

### Issues encountered

Covid delayed the compilation of Task outputs into KT factsheets and information for the sector but this has now largely been achieved. A Crop Walkers Guide to diseases and pests of Cherry Laurel is currently being prepared for printing.

### Please upload any supporting documents (Tables, images, graphs etc.)

*No Response*

### Queries

| DAFM query  | Coordinator response | DAFM Query Status | DAFM outcome |
|-------------|----------------------|-------------------|--------------|
| No Response | No Response          | No Response       | No Response  |
| No Response | No Response          | No Response       | No Response  |

### Is this task complete?

Yes

### Task completion date

31 December 2020

### Summary of Task Outcomes

The main outcomes of this task is more knowledge on the pathogens that cause shothole disease of *Prunus laurocerasus* in Irish cut foliage plantations and plant nurseries. The dominant organism associated with symptoms is the bacterium *Pseudomonas syringae* pv *syringae*, which was found on all commercial sites visited. A putative new pathogen with distinct symptoms was also identified as *Neofabraea actinidiae*. No *Xanthomonas arboricola* pv *pruni*, which is a 'Regulated Non-Quarantine Pest (RNQP)', was identified during the survey work undertaken. A crop walkers guide to the pathogens and pests of *Prunus laurocerasus* is in an advanced stage of production and will be made available to the sector.

A second outcome provided information on reducing shothole symptoms using alternative products to standard chemical pesticides. A trial of commercial products, which included a number marketed as plant stimulants and biological control agents, was conducted on an established *Prunus* plantation in Co. Kerry. The products were evaluated for their impact on shothole disease expression at harvest time and compared to disease levels on an untreated control as well a standard chemical control treatment. The results indicated that all products significantly reduced shothole incidence compared to the untreated control. Two products - a seaweed based product and a silicon based product gave reasonably good reductions of shothole symptoms for relatively low cost and fewer applications compared to the chemical control schedule. These products would need to be evaluated at a larger scale to see if the results are replicated across different sites. If successful, they offer a possibility to reduce reliance on chemical pesticides and would enhance the environmental sustainability of the sector.

### Describe how these outcomes may be relevant to end users such as Industry, Policy makers, Farmers or Practitioners.

These outcomes are highly relevant for cut foliage and hardy nursery stock industries who grow *Prunus laurocerasus* for cut foliage and hedging, respectively. Both sectors export a major proportion of their production and so are important to both the local and national economy. Tools that help them to identify and control diseases of their commercial crops are invaluable, especially when there is greater emphasis on environmental stewardship and reducing reliance on chemical pesticides.

The biostimulant and biocontrol type products performed surprisingly well in a small trial conducted on one cut-foliage site, but it is important to note that the mode of action of these products on the plant is not always known, thus the observed reduction in shothole disease symptoms is poorly understood. Further research is needed to understand how these products are interacting with *Prunus laurocerasus* to cause a reduction in shothole symptoms. Such products can enhance the strength and/or vigour of the plants or trigger or enhance plant self-defense mechanisms. Knowing more about how *Prunus laurocerasus* responds to individual environmentally-safe products is key to being able to provide science-backed advise that using such products is worthwhile.

**Describe how it has added to the research base (skills, leveraging of funding, infrastructure capabilities etc.)**

This is the first major research project to support the fledgling Cut-Foliage sector in Ireland. This work has helped to advance the skills and experience of a Teagasc Technologist and to train two contract horticulture technicians, who have gone on to obtain employment in Ireland in horticulture. During the project two undergraduates spent up to 6 months helping out on this task, gaining valuable experience as part of their science studies. The work has leveraged considerable interest from the commercial foliage community, DAFM Plant Health Division, and university researchers at TCD and UCD.

The task has resulted in two technology transfer publications for distribution to the sector and has cemented the relationship between the Teagasc horticulture research group and both the cut foliage and nursery stock commercial sectors.

**Section 5 - Progress and results achieved on Task 4****Do you require a fourth task?**

Yes

**Summary of Progress & Outcomes**

|                        |   |
|------------------------|---|
| <b>Task No.</b>        | <b>Task Title</b>   |
| 4                      | Epidemiology of Pseudomonas syringae pv syringae on Prunus laurocerasus |
| <b>Start date</b>      | 01 August 2016  |
| <b>Completion date</b> | 30 November 2019  |

**Milestone Progress**

| MS no              | MS title  | Status             | Summary of progress |
|--------------------|---|--------------------|---------------------|
| 1                  | Confirmation of susceptible cultivar for bacterial assays | Completed          | See PPR2            |
| 2                  | Completion of studies on temperature and humidity         | Completed          | See PPR3            |
| 3                  | Completion of field studies on wounding                   | Completed          | See PPR3            |
| 4                  | Inoculation of field samples with Pss                     | Completed          | See PPR3            |
| <i>No Response</i> | Collection of leaf samples from the field for analysis    | Completed          | See PPR3            |
| 0                  | <i>No Response</i>  | <i>No Response</i> | <i>No Response</i>  |

**Summary of Deliverable Status**

| Deliverable title   | Deliverable status |
|---|--------------------|
| 1. Identification of the conditions in which Pss growth and infection of P. laurocerasus is optimal | Completed          |
| 2. Technical report on the epidemiology of Pss on P. laurocerasus                                   | Completed          |
| <i>No Response</i>  | <i>No Response</i> |
| <i>No Response</i>  | <i>No Response</i> |

### Issues Encountered

The research has been completed on time but a publication on the epidemiology of P. laurocerasus (Cherry laurel) (D4.2) is still in preparation. This is due to the submission of an additional publication (not originally anticipated) on the novel pathogen M. aloverae to "Plant Disease" journal.

### Please upload any supporting documents (Tables, images, graphs etc.)

*No Response*

### Queries

| DAFM query         | Coordinator response | DAFM Query Status  | DAFM outcome       |
|--------------------|----------------------|--------------------|--------------------|
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |

### Is this task complete?

Yes

### Task completion date

30 November 2019

### Summary of Task Outcomes

Conditions which lead to increased shot hole disease have been established, these include exposed sites, mild temperatures and wounding. Some cherry laurel cultivars are more susceptible to the disease such as Rotundifolia, Novita and Etna. Humidity was not found to promote symptoms in cherry laurel leaves which were already infected. A new bacterial pathogen of cherry laurel was identified, Micrococcus aloverae.

### Describe how these outcomes may be relevant to end users such as Industry, Policy makers, Farmers or Practitioners.

The findings suggest that growing Cherry laurel under shaded conditions, with wounding minimised (for example from insects) would lead to less shot hole disease and more marketable stems.

The results show that growers should opt to plant the cultivar Caucasica which has the lowest susceptibility to shot hole even in exposed sites and when wounded.

**Describe how it has added to the research base (skills, leveraging of funding, infrastructure capabilities etc.)**

The information on cultivar choice and conditions which promote shot hole disease will be available to the foliage growers.

-Sequences of the new bacterial pathogen were submitted to the public database GenBank under Accession Nos. MN630641 and MN630642. These are now available to the research community.

-It has led to the training of MSc student Leighton Smith, who has skills in plant pathology specifically in horticultural bacterial pathogens. Leighton successfully submitted his thesis and will graduate in June 2020.

-Further investigation of shot-hole disease will take place as a 3 month taught UCD MSc project over the summer of 2020.

-This research also has the potential to lead to postgraduate IRC funding under the Enterprise Partnership scheme in 2020 with Forest Produce.

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## Section 6 - Progress and results achieved on Task 5

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**Do you require a fifth task?**

Yes

**Summary of Progress & Outcomes**

| Task No.               | Task Title  |
|------------------------|---|
| 5                      | Epidemiology of foliage pest invertebrates on Prunus laurocerasus and efficacy of pest control using foliage management practices and Plant Protection Products |
| <b>Start date</b>      | 01 December 2016  |
| <b>Completion date</b> | 31 December 2020  |

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**Milestone Progress**

| MS no | MS title  | Status    | Summary of progress |
|-------|---|-----------|---------------------|
| 5.1   | Complete the field monitoring of the first growth season and identify all the pests collected during the monitoring | Completed | See PPR2            |

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|     |   |           |   |
|-----|---|-----------|---|
| 5.2 | Complete the pest host association assessment in laboratory to inform the production of species fact sheets                           | Completed | None of the trials that were planned to be completed in the summer of 2020 could be conducted as a result of the delay in getting access to field sites and enforced limited access to UCD and facilities due to Covid 19 restrictions. Trials were planned for August and September as a result, but plants maintained at UCD did not have a second growth flush and trials could not be conducted. The laboratory based trials to expose CGC and the thrips in controlled conditions could not be completed. For this reason, the results obtained before this reporting period have been used to retrospectively assess the field damage recorded during the monitoring in 2017-2019. The damage recorded in the laboratory corresponds well with the damage recorded in the field and photos taken have been used in the pest fact sheets to inform growers.  |
| 5.3 | Complete the field monitoring of the second growth season and complete the epidemiology of the pests on cherry laurel                 | Completed | See PPR3.   |
| 5.4 | Complete the review of available PPPs and their potential use in current P. laurocerasus production systems in Ireland                | Completed | See PPR2  |
| 5.5 | Complete the laboratory assessment to determine the efficacy of the most promising PPPs against the priority pests of P. laurocerasus | Completed | This task was delayed as a result of the difficulties experienced in maintaining a population of both the thrips and CGC under caged laboratory conditions isolated on Cherry Laurel. Trials to inform the efficacy of the PPPs identified in M5.4 were planned to be completed in this reporting period but as a result of the restrictions access to field sites was not possible until July, limited laboratory access meant cultures could not be maintained when Cherry Laurel was at the right stage for exposure. As in M5.2, the trials were then planned when restrictions were less severe but the second flush did not occur to establish a culture of either species. Both require new expanding shoots and plant condition is critical to maintain cultures to use in the laboratory-based experiments. This task could not be completed as a result and remains to be assessed in future. An early application of the field based trial in Kildalton could not be conducted as a result of the Covid 19 restrictions in April/May 2020. The results from the trial in 2019 will have to provide direction on the early use of pesticides. Further work with growers will provide indication of the efficacy of the early preventative approach to insect pest management. |

|     |   |           |   |
|-----|---|-----------|---|
| 5.6 | Complete the assessments to determine the efficacy of PPPs when combined with the use of appropriate pesticides | Completed | As in M5.5. field collections of insects to be used to establish a laboratory culture was restricted during April-June 2020. This is the critical time for field collections and as a result field collections were planned for August-September. Culture plants maintained did not flush for a second time and the small window of opportunity due to the latter imposed restrictions meant that a lab culture could not be maintained. Planned collaboration with Teagasc staff for vial coating was restricted and as a result could not be completed at that time. These circumstances meant that the task aims could not be completed in 2020 and could not be completed in the life of the project as a result. Field based applications of PPPs in future seasons will have to provide guidance on their efficacy. Based on the target species the registered pesticides are recommended as part of the control options against insect pests outlined in fact sheets produced. |
|-----|---|-----------|---|

### Summary of Deliverable Status

| Deliverable title  | Deliverable status |
|--|--------------------|
| 1. Produce a list of invertebrate pests associated with <i>P. laurocerasus</i> , their associated damage, severity rating, seasonal activity pattern, likely promoting environmental factors and part of production cycle (seedling – foliage) affected. | Completed          |
| 2. Produce a fact sheet on each pest species and their epidemiology  | Completed          |
| 3. Produce a review document of the PPPs and their potential use in current <i>P. laurocerasus</i> production systems in Ireland   | Completed          |
| 4. Produce a document describing the efficacy of selected PPPs and potential use in foliage production   | Incomplete         |
| 5. Produce a list of recommendations for the integration of PPPs and selected pesticide use for pest control in <i>P. laurocerasus</i> foliage production  | Completed          |

### Issues Encountered

#### Issue Encountered: (1)

M5.3. Other PPPs were to be included in this review as information was made available from Deliverable 5.4, which remains incomplete, and as a result unregistered PPPs could not be assessed for use. This remains to be assessed in future research so D5.3 is now complete with respect to this project.

#### Issue Encountered: (2)

D5.4: This part of the project has had several delays as a result of difficulties experienced establishing a colony of the key pests on Cherry Laurel under laboratory conditions when isolated on cherry laurel. The pests to be exposed to PPPs, including the common green capsid and yellow flower thrips were planned for field collection in 2020. As a result of the COVID restrictions field collections could not be done at the appropriate times to coincide with pest occurrence on Laurel in the field. Trials on treated tubes in the laboratory were planned for late August and September but the restrictions, and limited laboratory access meant that populations could not be maintained and collaboration with Teagasc project partners presented too significant a risk. UCD had limited laboratory access and work in pods restricted interactions with Teagasc partners. This remains incomplete and will not be delivered as a result.

#### Issue Encountered: (3)

Deliverable 5.5: Although complete D5.5 does not include the PPPs that were to be tested as part of deliverable 5.4.



instead, the review includes the registered pesticides and assesses their use in accordance to the plant growth phase and pest insect likely to be active during that period.

The use of registered pesticides as control options are included in the fact sheets produced as Deliverable 5.2. This includes the most suitable pesticide and timing of spraying for each pest in years that support one flush and those in which two growth flushes occur.

**Please upload any supporting documents (Tables, images, graphs etc.)**

*No Response*

**Queries**

| DAFM query         | Coordinator response | DAFM Query Status  | DAFM outcome       |
|--------------------|----------------------|--------------------|--------------------|
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |
| <i>No Response</i> | <i>No Response</i>   | <i>No Response</i> | <i>No Response</i> |

**Is this task complete?**

Yes

**Task completion date**

31 December 2020

**Summary of Task Outcomes**

Intensive field monitoring in 2017 characterized the growth habits of two Cherry Laurel varieties, 'Etna' and 'caucasica', in commercial plantations which determined the growth phases susceptible to key insect and disease pests. Both active and passive monitoring (2017-2019) identified the pests on three laurel varieties, all highly variable in density on varieties, between sites and within the growing season, making predictions in pest occurrence very difficult. The use of pheromone based-traps proved variably successful and although they established the incidence of adults of some key insect pests (e.g. tortrix moth) the peak activity periods did not predict the pest's subsequent occurrence on the foliage. Monitoring of the damage to foliage identified the species and the timing of their incidence which informed a preventative management strategy for each of the key pests. Consistently, the pests insects made up less than 25% of all the leaf damage with the majority attributed to pathogens. Laboratory based trails indicate that most of the key pests require alternative host plants to sustain a population highlighting the importance of other plant species grown in commercial plantations. The tortrix moth was reared for multiple generations on cherry laurel under laboratory conditions. In a review of commercially available pesticides those targeting key pest species were highlighted and their timing of use to achieve optimal results were identified

**Describe how these outcomes may be relevant to end users such as Industry, Policy makers, Farmers or Practitioners.**

The results obtained form the basis of a pest management plan for Cherry Laurel. This is the first time the pests have been systematically recorded and damage followed through the seasons. The results inform farmers on the key pests and their relative importance compared to pathogens. Fact sheets detailing the insect pests on Cherry Laurel were produced, informing farmers on what the damage of each pest looks like, how to identify each life stage and lists the available control options for three key species. The identification of the growth stages of the plant will guide farmers in the use of pesticides in a preventative control strategy in years with the normal flush of growth (May to July) and in years when a second flush of growth occurs (August to September). The results also identify the species and plant growth stage that can now be targeted using biopesticides in the future as opposed to registered insecticides. The information is essential in moving to greener control options, a move demanded by the foliage industry.

**Describe how it has added to the research base (skills, leveraging of funding, infrastructure capabilities etc.)**

The information generated will provide farmers a way to identify key pests in plantations and has informed control options.

This task has led to the training of an MSc student Katalin Sorros at UCD, developing her skills in horticulture and entomology.

Two parasitoids recorded on tortrix larvae support the future use of natural predatory control options in plantations. The research has led to the identification of key research areas and highlighted the need for implementing the use of sustainable control options including biopesticides. This and the use of natural predators are key areas that are being addressed in recent and future funding calls.

The research highlights the significance of pathogens in plantations and strengthen the need for further research on these pests in combination with insects as possible vectors of these diseases.

The results form the basis of future funding through the IRC funding under the Enterprise partnership scheme with growers.

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## Section 7 - Progress and results achieved on Task 6

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**Do you require a sixth task?**

No

**Please upload any supporting documents (Tables, images, graphs etc.)**

*No Response*

## Section 8 - Progress and results achieved on Task 7

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**Do you require a seventh task?**

No

**Please upload any supporting documents (Tables, images, graphs etc.)**

*No Response*

## Section 9 - Progress and results achieved on Task 8

---

**Do you require an eighth task?**

No

**Please upload any supporting documents (Tables, images, graphs etc.)**

*No Response*

## Section 10 - Progress and results achieved on Task 9

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**Do you require a ninth task?**

No

**Please upload any supporting documents (Tables, images, graphs etc.)**

*No Response*

## Section 11 - Progress and results achieved on Task 10

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**Do you require a tenth task?**

No

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## Please upload any supporting documents (Tables, images, graphs etc.)

No Response

## Section 12 - Details of Modifications and Project Management

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### Staff

1. Dr. Afroze was out on six months maternity leave from June to November 2018 so progress with Tasks 1 and 2 could not proceed as planned. This absence plus the seven month delay in recruitment at the start of the project means there is a 13 month overall delay to progress in Tasks 1 & 2. We formally request that the project end date be extended to 31/12/2020 to facilitate completion of Tasks 1 & 2. A 14 month extension was agreed in principle by email to Project Co-ordinator Helen Grogan on 14 May 2018 by Mr. Aidan Holohan to 31/01/2021. Given that the delay is of 13 months rather than 14, we prefer to have the project end date at the end of the financial year 31/12/2020.
2. Dr Helen Grogan, Project Co-ordinator was out on bereavement leave in Feb/March 2018 and also out on sick leave for three months from May-August 2019. Task Leaders ensured all Tasks progressed as planned and Mr Brian McGuinness took a leading role in Task 3. Thus there was minimal impact on the project.
3. Dr Angela Feechan, Leader of Task 4, was out on maternity leave from March to August 2017, but this was not noted in PPR1.
4. PPR3. Dr. Gerry Walsh, Task Leader for Tasks 1 & 2 has retired (June 2019) and I (Project Coordinator) will oversee delivery of these tasks now.
5. PPR3. The technician employed on the project (Danielle Boland) resigned in Feb 2019 and a replacement technician was appointed in March 2019. The Teagasc technician has also spent extra time (3 months approx) assisting with survey work around the country which had been initially planned to be done by UCD in Year 1 & 2 (Task 5) but which was done by Teagasc instead.
6. PPR4. (2020). The replacement technician resigned the post 10 weeks early on April 30th 2020 as they had obtained another job. As this was during COVID , it resulted in some logistical problems for the project. It was decided to relocate the material that had been housed at the Teagasc Kildalton glasshouses up to the Teagasc Ashtown campus so that that Teagasc staff could look after the material and conduct the outstanding work required. this early termination of the technicians contract meant there would be unspent salary costs by the end of the project, which was originally to be 30November 2020. As the Post Doc researcher at Teagasc would be required to conduct extra work that had been planned for the technician, we requested a project extension to enable the Post Doc to work until Dec 31st 2020. This Request for Change was approved by DAFM on 6th October 2020.

### Approved Equipment

DAFM queried the spend on computer equipment by UCD for MSc student Leighton Smith, charged to Consumables, and disallowed it as it was not included in the original budget as 'durable equipment': DAFM Response: "Regarding invoices #2 and #3, computer equipment is not an eligible consumable claim. Computer equipment must be claimed for as durable equipment. As this was not on the proposal nor budget for UCD, the claim amount of €658.69 plus €197.61 of overheads will be deducted".

UCD have replied: "The MSc student (Leighton Smith) requires a basic laptop for data analysis, preparation of reports and presentations since there are no other laptops available for the student who is based at UCD. The full cost of the laptop is 658.69 and will be used for 23 months (of the 24 month MSc) and only for the "New Leaves" project. It was always intended to purchase a laptop for the MSc student. Therefore we request that the laptop cost ( including depreciation for 36 months according to DAFM guidelines, see below) of 421 EURO be reallocated to equipment from the consumable/travel budget". DAFM guidelines,  $[(A/B) \times C \times D] : = 23/36 \times 658.69 \times 100 = 421$  euro.

Due to a lack of suitably equipped available space at Teagasc Ashtown or Kildalton glasshouses, Teagasc will have a need in 2019 to install an irrigation system in a Kildalton glasshouse to accommodate the growth trials required as part of Tasks 1 & 2. This will cost in the region of 2-3000. Depreciated cost for the period of use will be in the region of 700-1000. We therefore request to allocate a portion of the budget to this cost if funds are available.

PPR3. This equipment was approved and is now installed in Kildalton.

PPR4. One Deliverable in Task 5 (D5.4) was unable to be completed, despite the best efforts of the Task Leader to do so, due to difficulties associated with COVID.

### **Other Significant Modifications or any other problems encountered / anticipated**

Teagasc have spent a major component of their travel budget due to Task 5 survey work being undertaken largely by Teagasc in 2017/2018 rather than UCD. Thus The UCD Travel budget is underspent while the Teagasc T&S budget is overspent. We request that some balancing and reallocation of UCD T&S budget (in the region of €8,000) may be required by the end of the project.

PPR3. An amendment was requested in July 2019 and approval was granted to transfer funds from UCD to Teagasc.

PPR3. The Teagasc Consumable and T&S budgets are already heavily spent at this point in time. Any future essential costs incurred in PPR4 that exceed the budget will be covered by Teagasc up to €3,000. However, if there are unspent funds remaining in the UCD budget at the end of the project we would request that they be transferred to cover any essential additional costs incurred by Teagasc in PPR4.

PPR4. The project has come in at approx €15,000 under budget.

### **Project Management and/or Advisory Groups**

20th March 2019; 3rd New Leaves Stakeholder and Steering Group Meeting at UCD, Belfield.

In attendance:

Dr Gerry Douglas; Dr. Farhana Afroze; Dr. Helen Grogan; Mr Brian McGuinness, Mr Andy Whelton; Dr. Angela Feechan; Mr. Leighton Smith; Dr. Jan Robert Baars; Ms. Katalin Soros;  
Dr Alistair Pfeifer; Dr Peter Jones; Mr. Donal Flanagan,

10th April 2019 Cut Foliage Steering Committee meeting at Teagasc, Ashtown.

Mr. Andy Whelton, Teagasc

Mr. Dermot Callaghan, Teagasc

Mr. Barry Delaney, DAFM

Mr. Michael Neary, Bord Bia

Mr. Felix McKendry, Enterprise Ireland

Mr. Simon Bellchambers, Forest Produce Ltd

Mr. Jim Costello, Forest Produce Ltd

Mr. Michael Doyle, Growers Representative

Dr. Helen Grogan, Teagasc

PPR4.

5 December 2019. Meeting with Industry Stakeholder at Teagasc Ashtown -

Mr. Michael Tibbs, Cut Flower Consultant, Netherlands

Mr. Andy Whelton, Teagasc

Mr. Dermot Callaghan, Teagasc

Dr. Helen Grogan, Teagasc

Dr. Farhana Afroze, Teagasc

Mr. David Wallace

18th Aug 2020 (Project Team Task Leaders meeting by Zoom)

Dr. Helen Grogan, Teagasc;

Mr. Andy Whelton, Teagasc;

Dr. Angela Feechan, UCD;

Dr. Jan Robert Baars, UCD;

(Mr. Donal Flanagan, Teagasc),

15 Dec 2020 (Project Technical Meeting by Zoom)

Mr. Andy Whelton, Teagasc

Dr. Helen Grogan, Teagasc

Dr. Farhana Afroze, Teagasc

Dr. Angela Feechan, UCD;

Dr. Jan Robert Baars, UCD;

(No general stakeholder event was held due to difficulties with COVID. An event is planned for the Summer/Autumn 2021).

## Training Courses

Dr Farhana Afroze: Contract Post Doctoral Researcher;  
Teagasc Postdoctoral Training:

1. Induction Programme, 5-6th February 2018, Johnstown Castle.
2. Advanced Scientific Writing and Presentation skills, Fermoy, from 21-22 the March 2018, Fermoy.
3. Online course (free): Certificate on online course on 'National Adaptation Plans: Building Climate Resilience in Agriculture' conducted by FAO (Food and Agriculture Organization of the United Nations), 2018.

Mr. Leighton Smith, MSc Student at UCD;

1. CPC30100 Emerging Crop Pathogens .Sept 2017-2018 (B+).

PPR3.

Dr Helen Grogan; Coordinator and Task Leader for Tasks 1, 2 and 3:

Epigeum Research Integrity Course: 8 May 2019 - online  
Manual Handling – theory (online) and practice; 2 September 2019 (Teagasc)  
GDPR compliance (Teagasc); 14 Sept 2018 - online  
Data management training course; 10 October 2019 - (about 20 attending)

Mr. Brian McGuinness (Task 3 co-leader)

Epigeum Research Integrity Course: 11 Dec 2019 - online

Dr. Angela Feechan (Task 4 Leader)

Epigeum Research Integrity Course: 1 Oct 2018 - online

Dr. Michael Gaffney (Task 5 co-leader)

Epigeum Research Integrity Course: 3 Dec 2019; - online

Dr. Farhana Afroze (Contract Post Doctoral Researcher);

Library & Information Service Training Day, 1st April 2019, Ashtown.

Lab Safety Fundamental Course' in Ashtown on 2nd of October 2019.

'Engaging with media' on 24th October 2019 at Ashtown.

'Engaging with Policy Makers' on 25th October 2019 at Ashtown.

R-Statistics. 9-10th December 2019. Moorepark, Fermoy.

Teagasc and SRUC's Joint Conference-Rural Futures II-Friday, 6th of December 2019.

PPR4

Dr. Farhana Afroze (Contract Post Doctoral Researcher);

Training in R Statistics given by Sean Lacey (Lacey Maths and Stats Consultancy company Limited) via Microsoft Team.

1. Essential Statistics in R, Day 1 on 14/09/2021

2. Essential Statistics in R, Day 2 on 15/09/2021

3. Essential Statistics in R, Day 3 on 18/09/2021

4. Multivariate Data Analysis in R studio, 25/09/2021

5. Multivariate Data Analysis in R studio, 29/10/2021

6. Advanced Statistics in R(1), Multiple Linear Regression Analysis, 30/10/2021

7. Advanced Statistics in R(2), Multivariate analysis-Partial Least Squares Regression and Principal Component Regression, 26/11/2020

## Please upload any supporting documents (Tables, images, graphs etc.)

*No Response*

## Queries

| DAFM query  | Coordinator response | DAFM Query Status | DAFM Outcome |
|-------------|----------------------|-------------------|--------------|
| No Response | No Response          | No Response       | No Response  |
| No Response | No Response          | No Response       | No Response  |

## Section 13 - Outputs, Impacts & Knowledge Transfer

### Outputs

| Research output           | Total number | Details of output - include DOI, citation reference, website, etc   |
|---------------------------|--------------|---|
| Peer reviewed publication | 4            | <p>L. Smith, H. Gibriel, C. Brennan, M. del Pino de Elias, A. Twamley, F. Doohan, H. Grogan and A. Feechan.<br/>First Report of Shot Hole disease on Cherry Laurel (<i>Prunus laurocerasus</i>) Caused by <i>Micrococcus</i><br/><a href="https://doi.org/10.1094/PDIS-03-20-0521-PDN">https://doi.org/10.1094/PDIS-03-20-0521-PDN</a><br/>Plant Disease Vol 104 No. 10 Aug 2020</p> <p>Farhana Afroze, Gerry Douglas and Helen Grogan.<br/>A comparative study on seed physiology and germination requirements for 15 species of Eucalyptus.<br/>Currently under 2nd review with Theoretical and Experimental Plant Physiology.</p> <p>Farhana Afroze, Gerry Douglas and Helen Grogan. Micropropagation of <i>Pittosporum tenuifolium</i> 'Purpureum'<br/>Currently at an advanced stage of preparation for submission to Plant Cell Tissue and Organ Culture</p> <p>Farhana Afroze, Gerry Douglas and Helen Grogan.<br/>Micropropagation of <i>Hebe speciosa</i> and the generation of polyploids using colchicine and oryzalin<br/>Currently at an advanced stage of preparation for submission to Plant Cell Tissue and Organ Culture</p> |

|                                 |   |  |
|---------------------------------|---|--|
| Technical article               | 2 | <p>Helen Grogan, Leighton Smith , Brian McGuinness, Angela Feechan.<br/>Spot the difference on cherry laurel<br/><a href="https://www.teagasc.ie/publications/2020/tresearch-summer-2020.php">https://www.teagasc.ie/publications/2020/tresearch-summer-2020.php</a><br/>T-research Jul 2020</p> <p>Helen Grogan, Angela Feechan.<br/>Shothole study makes new discoveries<br/><a href="https://horticultureconnected.ie/horticulture-connected-print/2020/summer-2020/research-summer-2020/shothole-study-makes-new-discoveries-helen-grogan/">https://horticultureconnected.ie/horticulture-connected-print/2020/summer-2020/research-summer-2020/shothole-study-makes-new-discoveries-helen-grogan/</a><br/>Horticulture connected Jul 2020</p> |
| Conferences & Seminars attended | 3 | <p>Angela Feechan &amp; Leighton Smith.<br/>Teagasc Seminar for National Botanic Gardens Horticulture students and staff - 12 Dec 2019. (20 Attendees - ).<br/>The epidemiolgy of shothole on the cut foliage crop Cherry Laurel.</p> <p>Angela Feechan.<br/>Teagasc Webinar - 22 July 2020.<br/>The epidemiolgy of shothole on the cut foliage crop Cherry Laurel.<br/>Teagasc Nursery Stock Webinar Meeting for the nursery stock sector<br/>35 attendees</p> <p>Angela Feechan.<br/>Agricultural Botany and Emerging Crop Pathogens modules, UCD. 27 Sept 2020.<br/>Agricultural Botany: 150 students.<br/>Emerging Crop Pathogens: 12 students.</p>  |
| Other output                    | 2 | <p>YouTube Video Clips.</p> <p>Farhana Afroze, Brian McGuinness and Leo Finn.<br/>Short video of Hebe polyploids developed during the New Leaves project.</p> <p>Farhana Afroze, Brian McGuinness and Leo Finn.<br/>Short video of Eucalyptus research done during the New Leaves project.</p>   |

|              |   |  |
|--------------|---|--|
| Other output | 5 | <p>Factsheets in progress:</p> <p>Andy Whelton, Farhana Afroze, Helen Grogan.<br/>Eucalyptus Propagation factsheet.</p> <p>Angela Feechan, Leighton Smith, Brian McGuinness, Helen Grogan.<br/>Shot-hole disease in cherry laurel (Prunus laurocerasus)</p> <p>Three pest Factsheets are also planned on:<br/>(1) Tortrix moth (2) Green capsid and (3) thrips</p> |
| Other output | 1 | <p>Prunus laurocerasus - crop walkers guide to diseases and pests.</p> <p>Brian McGuinness, Andy Whelton, Jan-Robert Baars, Helen Grogan .</p> <p>(Currently being formatted for printing)</p>   |

#### Staff recruited

| Staff category             | Female | Male | Total number |
|----------------------------|--------|------|--------------|
| Technician / Research Asst | 1      | 1    | 2            |
| Post doctoral researcher   | 1      | 0    | 1            |
| Masters student            | 1      | 1    | 2            |

#### Research to Policy

| select below | Total number | Details of policy |
|--------------|--------------|-------------------|
|--------------|--------------|-------------------|



Under Harvest 2025 and with the cut foliage stakeholder development group comprising Teagasc, DAFM, Bord Bia, Enterprise Ireland, growers and processors, targets were set to achieve 400 ha of cut-foliage production worth €20m, creating 400 jobs. Currently the industry is at 220ha worth €7m with 200 people working in production, processing and marketing. Key species including Eucalyptus, Laurel and Pittosporum will account for the lion's share of new planting planned over the next 3-4 years. Smaller areas of other species such as Brachyglottis, Viburnum, Olearia and Rosemarinus will also be planted. Demand for grey species of Eucalyptus in particular have exceeded expectations with flower bouquet processors for supermarkets and Dutch wholesalers demanding the product all year round. An expanding on-line market for Eucalyptus foliage garlands supplying florists and the eventing sector in UK and Europe continues to evolve at pace. Elements of the information that has emanated from the recent 'New Leaves' work particularly in relation to pest & disease issues on Cherry Laurel and in furthering the propagation of Eucalyptus specifically has contributed positively to the ongoing scale up of this sector of commercial horticulture.

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|                     |   |  |
|---------------------|---|--|
| Policy verification | 1 | <p>The new Leaves project conducted a survey of cut foliage and hardy nursery stock businesses during the project. One task included testing material for the presence of <i>Xanthomonas arboricola</i>, which as DAFM plant health were looking to see if Ireland could be a protected zone for this pest.</p> <p>Although DAFM now list this bacterium as a 'Regulated Non-Quarantine Pest (RNQP)', the project established that it was not detected among the samples that were tested during the project. This was additional work as both the nursery stock and cut foliage sectors were keen to have information on the presence or absence of this organism, due to potential plant health issues with plant exports.</p> |
| <i>No Response</i>  | 0 | <i>No Response</i>   |

## Impacts

| Impact type    | Total number | Details of impact   |
|----------------|--------------|---|
| Research links | 3            | <p>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.</p> <p>Contact with Waterford IT has been advanced. Level 8 students engaged with the New Leaves technician at Teagasc Kildalton for final year project work.</p> <p>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.</p> |

New product

2

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

Similarly, there are a number of unique Eucalyptus clones from the irradiation treatment. However, further development research is needed to determine their suitability and appeal 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 propagators of the material. However, it is important to state that plant breeders rights will not be sought until the material can be validated as of commercial interest and that requires further research to be done. However, there are limited avenues for research funding for this work.

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New process

4

New micropropagation methods have been developed for a number of species of interest to cut foliage. Of especial interest is the micropropagation protocol for hard-to-propagate material of Eucalyptus.

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

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This 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.

Irish Green Guys is a new online company selling foliage, and

Coillte grow eucalyptus for biomass and keeping in touch regarding research outputs on propagation.

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Other impact

0

*No Response*

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### Knowledge Transfer Activities





| KT Activity          | Total number | Details of KT Activity   |
|----------------------|--------------|--|
| Stakeholder meetings | 0            | No stake holder event was held in 2020 due to Covid but an event is planned for 2021 |





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|                   |   |  |
|-------------------|---|--|
| Other KT activity | 2 | Two KT events were held in 2019/2020 as detailed in outputs -a presentation at the Nursery Stock Sector Webinar on 22 July 2020 and a seminar given to students on the Teagasc/National Botanic Gardens Horticulture course. |
| No Response       | 0 | No Response  |

**Please upload any supporting documents (Tables, images, graphs etc.)**

 [New Leaves Dissemination 7e PPR4 2020 draft3](#)  
 02/06/2021  
 11:30:59  
 xlsx 20.75 KB

 [8-9-Spot-the-difference-on-laurel-leaves TResearch published](#)  
 02/06/2021  
 11:25:45  
 pdf 678.86 KB

 [Shothole HortConnected Summer 2020](#)  
 02/06/2021  
 11:25:45  
 pdf 192.83 KB

**Queries**

| DAFM query  | Coordinator response | DAFM Query Status | DAFM Outcome |
|-------------|----------------------|-------------------|--------------|
| No Response | No Response          | No Response       | No Response  |
| No Response | No Response          | No Response       | No Response  |

**Section 14 - Declaration**

**Declaration**

**I, the undersigned, hereby declare that all the information provided by me in connection with this report is accurate, complete and true to the best of my knowledge. I undertake to maintain such records as may be required by the Department of Agriculture, Food and the Marine.**

Checked

**Name**

Helen Grogan

**Are there any deductions to be made? (To be completed by DAFM)**

- Yes
- No