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## Improving strawberry 'tray plant' production technology in Ireland



### Key external stakeholders:

Strawberry plant propagators, strawberry producers, commercial horticultural researchers, substrate suppliers, commercial horticulture students

### Practical implications for stakeholders:

- High quality strawberry 'tray plants' can be grown very successfully in both protected cropping and outdoor in Ireland.
- Very high yields of marketable quality can be achieved using these plants.
- Less plant disease risks by using Irish plants.
- Substantial cost savings and added security by growing and using your own 'tray plants'.
- Plant dissection and flower analysis provides a very good indicator of plant quality and future cropping patterns.

### Main results:

- 'Elsanta' and 'Sonata' tray plants were grown very successfully both indoors and outdoors. Yields of  $\geq 600\text{g}$  per plant were obtained from both cultivars in the first and second year of cropping. Quality parameters were also very good.
- Time of runner harvest is critical with early to mid July being the optimum. Other parameters including runner grade, runner size and substrates used can also influence yield and quality.

### Opportunity / Benefit:

Strawberry growers now have the technology to propagate their own plants. They have less reliance on imported plants where plant disease risks and costs are higher. This information can be accessed by all growers through the Teagasc Horticultural Development Unit. The work can be used as a foundation for future strawberry propagation work.

### Collaborating Institutions:

UNIVPM, Italy  
UCD

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### 1. Project background:

The fruit growing season in Ireland has changed fundamentally over the last decade. In the past, the strawberry season lasted from June to July. Today, through new technology the season has been extended from April to November. The strawberry industry has grown by over 190 percent in the last decade and is now worth an estimated €35 million. Unfortunately, the Irish strawberry propagators are limited in their supply of plants for extended season production. There is now a demand for the use of strawberry 'tray' plants in protected strawberry production. Tray plants have gained popularity and have formed an important part of the growing system among growers in the Netherlands, Belgium and in surrounding countries such as France, the UK and Italy.

Tray plants are replacing 'waiting bed' and A+ plants. They offer many advantages over soil grown 'bare root' plants. Runners and cuttings are grown on substrates, reducing the risk of infection by root diseases to a minimum. Plant nutrition can be controlled completely; plants can be more easily lifted during frost and wet conditions and the roots remain intact in comparison to 'bare root' plants. This improves plant storability and establishment after cold storage. Tray plants also produce 10 to 20 percent more large fruits than 'bare root' plants which reduces picking costs substantially.

When the project began, the knowledge in regard to tray plant production technology in Ireland was scarce. Research was undertaken to establish and test a tray plant production system for the Irish strawberry propagators who wished to set up such production. Research was also conducted to better understand strawberry growth and flowering. Strawberry flower induction is sensitive to temperature and photoperiod and to several agronomic and nutritional factors. The aim of this research was also to improve the cultural knowledge and understanding of the physiological control of axillary meristems, which can enhance strawberry fruit production. It may be possible to programme axillary meristems to a particular grower's requirements/part of the growing season.

### 2. Questions addressed by the project:

- Would it possible to grow high quality strawberry plants (cv. 'Elsanta' & 'Sonata') in Ireland and to produce satisfactory yields and quality from the same?
- What effect would strawberry runner harvest date have on subsequent yield and quality of the plant?
- Would runner grade (size) and runner order have any effect on plant yield and quality?
- Would tray-plant substrate type influence subsequent tray plant quality attributes and or yield and strawberry quality parameters?
- What role does strawberry plant dissection and architecture analysis serve for a tray-plant producer? And is this information of use for the final strawberry producer?

### 3. The experimental studies:

All strawberry runners' cv. 'Elsanta' and 'Sonata' were grown from 'super elite' stock planted in unheated glasshouses. Runner tips were harvested from these mother plants and planted into peat modules and grown in a glasshouse. Runner tips were harvested on different dates in July and early August. On one occasion they were graded into three different grades, small, medium and large and in other experiments they were graded according to primary, secondary and tertiary runner order. Different substrates were also used in the propagation of the tray plants including a number of peat grades, composted green waste (CGW) and cocoa peat (coir). Measurements of plant crown size and root biomass were conducted.

Plants were grown both in an unheated glasshouse and outside in beds. Nutrition was carefully controlled. Strawberry tray plant crowns were dissected throughout the growing season. The flowering

stage of the primary flower in the main crown and in lateral crowns was determined using a stereo microscope. A photographic chart showing the nine stages of strawberry flower development was used to aid this work. A total plant flower count was also conducted as part of the dissection. When the plants were finally harvested they were placed into cold store. They were subsequently planted as per industry norms at a final density of 10 plants per m<sup>2</sup>.

#### 4. Main results:

- Tray plants were grown very successfully both inside and outside. There were very few plant deaths. Crown size diameters of between 15 and 19 mm were obtained.
- Total yields of 12.73 kg/m<sup>2</sup> and 13.2 kg/m<sup>2</sup> were obtained with cv. 'Elsanta' and 'Sonata' respectively. 'Sonata' also had a significantly higher score for marketable quality.
- During runner production the mean total number of primary, secondary, tertiary and quaternary runner cuttings from 'Elsanta' and 'Sonata' were 31 and 38 per plant respectively. The time of runner harvest had a significant effect on the subsequent yield of the tray plant. Early July is the optimum time to harvest and plant runners. This is to maximise crown diameter, initiated flower number and development stage together with leaf number and crop yield.
- Runner size (grade) has a significant effect on fruit yield and quality parameters. Average fruit yield was highest where larger runners were used for propagation earlier. Yield reduced significantly for those harvested later in the season (19<sup>th</sup> July).
- When fruit yield was assessed, there was no significant difference effect between primary, secondary or tertiary runners which were planted for rooting at the three different dates.
- As regards peat substrate (coarse & fine) this has no effect on the yield and quality in the early runner harvest date. However, the yield and quality parameters of the large runner grade were highest when this was propagated using the finer peat substrate later in the season (19<sup>th</sup> July).
- Primary runner plants propagated in 100% peat, a 1:1 cocoa peat (coir)-peat mix and a 1:1 composted green waste (CGW)-peat mix gave the highest yields and marketable quality. Crown diameters were also highest in these treatments.
- Highest root dry weight was obtained from plants propagated in peat or a 1:1 peat cocoa-peat (coir) mix.
- Strawberry crown dissection resulted in a very clear picture of the various stages of flower formation that the plant goes through. This could be used as a method to further determine plant flower quality characteristics throughout the whole growing cycle in the nursery. Using strawberry flower 'architecture analysis' can help further in the development of specific flower quality attributes which are demanded now by the industry.

#### 5. Opportunity/Benefit:

The primary stakeholders for this research are the Irish strawberry producers and the Irish strawberry plant propagators. Propagators now have a dedicated protocol for the production of their own 'high quality' plants. The fruit yields and quality produced in these trials were excellent and were equal to or better than those seen in more advantageous climates. Some propagators have already invested heavily to produce plants for their own use, for the Irish market and perhaps for export in the future.

A number of propagators have recently started to propagate their own plants based on this Teagasc research and are also achieving excellent results e.g. ≥ 600g/plant. All of this means less reliance on imports where plant disease risks are higher. This is a low risk country as regards plant disease. This is a major advantage in regard to intensively grown plants. There is also added security in producing your own plants as well as a substantial cost saving in doing so.

#### 6. Dissemination:

The results of this research have been presented at both Teagasc (<http://www.teagasc.ie/publications>) and International conferences including the COST 863 'Euroberry' group ([www.euroberry.it](http://www.euroberry.it)). The results were also presented in Beijing, China. Growers have also visited the facility at Teagasc Kinsealy and further advice is given through the advisory-research service. Results have also been reported through some national and international media channels.

#### Main publications:

Beyene, G.T., Kehoe, E., Hunter, A. and MacSiúrtain, M. (2012). Effect of Different Substrates on Rooting and Flower Development of Primary and Tertiary Runners of Strawberry tray-plants cv. 'Elsanta'. Proceedings of the 7<sup>th</sup> International Strawberry Symposium, Beijing, Peoples Republic of China. 18-22

February, 2012. (In print)

Beyene, G.T., Kehoe, E., Hunter, A. and MacSiúrtain, M. (2010). Effect of Different Transplanting Dates and Runner Types on Quality and Yield of 'Elsanta' strawberry. 28<sup>th</sup> International Horticultural Congress on Science and Horticulture for People (IHC2010). International Symposium on Berries: From Genomics to Sustainable Production, Quality and Health. *Acta Horticulturae*, 926: 483-489.

Kehoe, E., Savini, G. and Neri, D. (2009). The Effects of Runner Grade, Harvest Date and Peat Growing Media on Strawberry Tray Plant Fruit Production. Proceedings of the 6<sup>th</sup> International Strawberry Symposium. *Acta Horticulturae*, 842: 699-702.

**Popular publications:**

Kehoe, E. (2007) Designing the perfect strawberry plant. T-Research.2 (2) 28-29.

Kehoe, E. (2010) Designing the perfect strawberry plant. T-Research 5 (2) 22-23.

Kehoe, E. (2006-2012). Proceedings of the Teagasc National Soft Fruit Conference and Trade Show. [www.teagasc.ie/publications](http://www.teagasc.ie/publications)

**Thesis:**

Beyene, G.T. (2012). Improving Strawberry Module Plant Production Technology in Ireland. Ph.D. Thesis. University College Dublin. 226pp.

**7. Compiled by:** Dr. Eamonn Kehoe