National Soft Fruit Conference Proceedings

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The Proceedings from the National Soft Fruit Conference are also available for downloading in Acrobat PDF format

Advances in biological control for soft fruit growers

David Foster,

Koppert Biological Systems.

Natupol – natural pollination

Pollination by bumblebees

Successful fruit set is essential in agricultural and horticultural crops. Pollination, the key to fruit setting, is usually carried out by insects and other animals, or through mechanical means. Historically, honeybees have been considered the best pollinators of agricultural and horticultural crops. In the late 1980's however, it was discovered that bumblebees are less sensitive to low temperatures and low light intensity, are more inclined to stay in the crop, and have a higher working rate (number of flowers visited per minute) than honeybees.

Bumblebees can be used effectively for the pollination of a variety of protected and open field crops such as pepper, aubergine, melon, strawberry, blackberry, raspberry, blueberry, redcurrant, blackcurrant, cranberry, apple, pear, plum and cherry.

Bumblebees are also suitable for the pollination of seed production crops, such as cabbage. Koppert supplies the bumblebee *Bombus terrestris* under the name NATUPOL.

Natupol at work

NATUPOL can be placed in the crop from the moment that the first flowers is open. Koppert has devised a crop-based delivery schedule that ensures optimal pollination by supplying the appropriate number of hives for the area to be pollinated. It is also possible to order individual hives. The bumblebees are delivered in a hive enclosed in a cardboard box.

Koppert have recently made several modifications to the design of the hive to increase brooding space and improve ventilation to provide a better internal climate for the colony, which will enhance the performance of the bumblebees.

Bumblebees need a specific type of food, so Koppert hives contain a ready-to-use sugar solution to guarantee that the bumblebees remain healthy and active. The sugar solution is enclosed in a maintenance-free drinking system that comes complete with reservoir so that refilling is not necessary. This unique system ensures maximum purity. Moreover, the sugar solution cannot be accessed outside the hive by honeybees or wasps.

HIVE TYPES

The hive types are shown below. The effective pollination period and range for the hives is dependent on colony size, but can also vary according to crop type and environmental conditions. The data given is typical for strawberries.

Type (code)	**Colony size** (workers/queens)	**Pollination period** (weeks)	**Range** (m^2)
Small (S)	40-50 / 1	6 - 8	Up to 750
Normal (N)	50-60 / 1	10	Up to 1000
Extra (E)	70-80 / 1	10 - 12	Up to 1500
Tripol (T)	250 / 3	10 - 12	Up to 5000

Cane Fruit

In certain crops the effective range of the hives is less than that given. In particular, many varieties of raspberries have a condensed flowering period, in which relatively high numbers of bees are required for optimum pollination. In these crops it is recommended to use Extra hives @ 1 hive/1000 m^2, or Tripol hives @ 3 hives/ha.

What is tripol?

TRIPOL is a product from Koppert, developed especially for pollination in field crops such as cherry, plum, apricot, peach, pear, apple, strawberry, blackberry, raspberry, blueberry, red currant, blackcurrant and kiwi. Bumblebees remain active at low temperatures (10ºC), and are therefore more suitable for early flowering crops than honey bees, which only become fully active at 18ºC.

One TRIPOL hive contains 3 bumble bee colonies, each containing at least 80 - 100 worker bees, with each hive having a life span of between 6 and 10 weeks. Each colony has been provided with extra insulation and a small amount of sugar water, essential during transport and for the first few days in the field. The TRIPOL hive is constructed from weather-resistant plywood, and is strong enough to protect the contents from badgers or other animals. The hive also ensures optimal distribution and establishment of the colonies in the field.

Spical – *Amblyseius californicus*

A new strain of SPICAL A*mblyseius californicus* is currently being scaled up for commercial supply, which has an extended transport and storage period, enhanced egg production and improved efficacy in the field compared with the existing strains currently available. SPICAL can be extremely useful as part of a mite control strategy for soft fruit.

ADVANTAGES OF SPICAL - *Amblyseius californicus*

(a) *Amblyseius californicus* is not as temperature dependent as *Phytoseiulus persimilis* and can develop better at high temperatures (33 ºC) and lower humidity.

(b) *Amblyseius californicus* can be introduced more preventively in contrast to *Phytoseiulus persimilis* and it is not cannibalistic. *A. californicus* can starve for a longer time.

(c) *Amblyseius californicus* is able to build up a population on pollen and can survive on it.

(d) *Amblyseius californicus* doesn't eat only *Tetranychus urticae* but is also effective against a range of other mite species including: broad mite (*Polyphagotarsonemus latus*), cyclamen mite (*Tarsonemus pallidus*), *Brevipalpus sp.* and *Tyrophagus sp.*

(e) *Amblyseius californicus* is more resistant to chemicals in comparison with *P. persimilis* (see Koppert Side Effects Guide)

Trianum: Root protection

Strain T-22, the active ingredient in TRIANUM-P and TRIANUM-G is a highly effective, patented hybrid *Trichoderma harzianum* that forms a protective barrier on the root system to protect plants against root rotting fungi. It colonises the outer root surface and surrounding soil particles, and feeds on products released by the roots, thus removing the pathogen's food supply.

TRIANUM grows best at a pH of 4 - 8, in soil, peat and bark based mixes, between 9 – 35 ^{o}C. It is a living organism, which will continue to grow as the root system expands. It has a zero hour re-entry interval, meaning that crops are safe to handle or harvest even before the spray has dried. A single application provides up to 3 months protection, preventing pathogens such as *Pythium*, *Rhizoctonia*, *Fusarium*, *Sclerotinia*, *Thielaviopsis* and *Cylindrocladium* from occupying space on or near the root zone. TRIANUM also protects against secondary infections resulting from insect damage to the roots. It has no adverse effects on humans, animals, or plants, and is listed by the Organic Materials Review Institute in the USA and the Soil Association in the UK as suitable for use in organic production.

Using TRIANUM reduces production costs by shortening bench time, reducing chemical inputs and reducing labour. Treated plants may also show improvements in overall health and development, especially in terms of root growth.

TRIANUM has a shelf life of up to 6 months when stored at room temperature, or 12 months in cold storage.
It can be used in conjunction with all insecticides, fertilisers, rooting compounds, growth regulators, non-ionic surfactants, and most fungicides.

A new product for the control of powdery mildew

Koppert Biological Systems are currently developing a unique product initially for the control of powdery mildew, but with the potential for use against a range of other important fungal diseases. The product will be used as a curative control treatment and will kill fungal spores and mycelium via contact action. The product is only active during the water phase of application and therefore has no preventative or persistent effect. Approximately 24 hours after application the fungus is killed and may turn grey in colour or the fungus may disappear completely from the leaf. As the product has a unique mode of action there are no resistance problems. The product is safe to natural enemies and bumblebees, safe to humans, plants and the environment and has great potential for ICM and organic production systems.

Increasing the selling power of Irish soft fruit.

Mr.Brian Kelly
Fresh Produce Buyer, Superquinn Group.

The fresh fruit industry in Ireland is worth about €350 million. This is about 41% of the fresh produce market. Of this strawberries account for about €14 million. The types of consumers that spend the most on fruit are the ABC income group, with children in the larger households and middle-aged families.

The demand for product is very seasonal co-inciding with the main growing season. Market demand for volume and value peaks over the key summer months from May to September. Market demand falls away in the last quarter of the year as availability tightens.

Ways to stimulate Sales

During my presentation I will discuss some of the factors that improve the selling power of Soft fruit:

- Fluctuation in price of produce. This does not allow for the consumer to become loyal to a brand.
- Spanish growers trying to capture more of the Northern European season, through the investment in growing techniques and newer varieties. This must be addressed and challenged.
- Taste -industry research required into Irish production. Heavy reliance on 'Elsanta'. Is this still the best? Evaluation of newer varieties under Irish conditions. It is essential that if we are too push an Irish product that it meets its taste requirements. Irish product must be fresh and tasty.
- Large variation in size affects the consistency of the produce and when product is scarce. Inferior size being used devalues the image of Irish berries.
- Stimulate the interest when there is sufficient Irish supply at the start of the season.
- We need to make the introduction of the new season a wow factor and tell customers how important it is? Passionate about fruit. To drive national sales it needs to be industry led. Television advertisements and in store promotions.
- Theme days. Invent a new theme day through association. Unfortunately Valentines Day is too early for Irish Strawberries.
- Linkage to events like Wimbledon and export markets.
- Make a brand of your berry. Customers know Fyffes and Chiquita bananas. Make a brand of your product.
- Consistency in supply and quality. If product is not available we cannot sell it. If the product is not within specification we cannot sell it. A customer will tolerate shortages.

- Product forecasting. The grower has to be able to give as accurate as possible information to the retailer in relation to following weeks supply so that specials if planned can be met.
  It may be possible for the retailer to promote other Irish soft fruit during a time when Strawberries are scarce for a week or two This may be an opportunity to push blueberries which may be more plentiful at the time.
- Reducing the gaps in the importation market during the Irish season by better planning and communication with your retailer.
- Linkage. Strawberry and cream promotions push our sales by 300%.
- The heath benefits of soft fruit are not widely known by the consumer. Why is this? This is probably the main marketing points. Information regarding a tasty snack with low calorific content.
- The increase in the convenience market how do we make soft fruit a handy snack item?
- The heath benefits are important, but berries are also seductive and should be linked with chocolate and champagne. It's a luxury indulgence.
- In store promotion of you product. Growers come and meet the customer and let tell them why they should buy your product.
- Packaging types. Too much plastic is the response that we are getting back. There are biodegradable materials. Emphasise the naturalness of your product.
- We have limited organic production of berries, with increased IPM and ICM principles being undertaken by growers. Why is this niche not being exploited by an Irish grower?
- Mix berry packs. It is expensive to by 3 packs of berries. Why not give one pack with a combination of berries?
- What creates the boomerang affect for the customers? People, as we know buy with their eyes. What makes your product stand out from others?
- Long stem strawberries
- Bright red colour
- Consistent size around 35-40mm.
- Packaging
- Labelling. Identify the product as being Irish. When asked 67% of Irish consumers said they would preferentially buy Irish but when asked if it was more expensive than imported, only 34% would still commit to Irish.

So we can stimulate an initial purchase reaction to Irish berries, but the price must meet the quality. Spanish growers are trying to capture more of the Northern European season, through the investment in growing techniques and newer varieties. This has the potential to erode existing markets, if the Irish quality and quantities are not there.

- If product is stored, investment in humidified storage and appropriate field heat removal.
- Fruit firmness and extension of shelf life.
  After the purchase the customer will look for taste and shelf life. How do we improve both aspects of the product?
- The colour

To recapture the customer the taste needs to be right. The desired sugar levels and the correct acid: sugar ratio. A taste guarantee certificate. This means that the grower is confident that his product has reached a satisfactory taste. Gaining the trust of the customer is how we generate the boomerang affect.

Can biological control agents replace chemical fungicides?

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Introduction

Grey-mould disease of fruit caused by the fungus *Botrytis cinerea* is the most important disease affecting strawberry worldwide. Typically, control of this disease is achieved through a combination of crop management (e.g. removal of dead foliage, judicious management of N-fertiliser) and chemical fungicides. However, the use of chemical pesticides in agriculture has come under scrutiny in recent years for two important reasons. Firstly, consumer sensitivity to pesticide residues in food has lead to calls for reduced usage. Secondly, there is the possibility of the pathogen developing resistance to the fungicide, a problem observed in *Botrytis cinerea* e.g. benzimidazoles in the 1970s and dicarboximides in the 1980s (Hewitt, 1996). With these two points in mind, reduction in chemical usage is seen as a key component to the sustainability of the Irish strawberry industry. One method for reducing usage is the development and use of biological control agents (BCAs; defined as an organism(s) used to control a target pest/disease) as part of a disease control strategy. They work by (1) competing for space and nutrients, (2) directly parasitising the target, (3) producing substance(s) inhibitory to the target or (4) combinations of these actions. BCAs have successfully been used for disease control in a variety of fruit and vegetable crops, including strawberries and raspberries. This success has seen the development of many BCAs as commercial formulations.

Research conducted by NUI Maynooth and Teagasc, started in 2002, has looked at new ways of achieving effective *B. cinerea* within a low chemical input strategy, BCAs are seen as an integral part of this strategy and are being evaluated on their own in outdoor and protected production systems as well as part of a decision support system in outdoor production systems. Results of early trials on the use of commercial BCAs in a protected strawberry production system are presented here.

Outline of the trial

Trials were carried out in the Teagasc research station at Clonroche, Co. Wexford during the summer of 2003. Strawberry plants of cv. Elsanta (13 mm crowns) were sown in peat bags (10 plants per bag), placed in a polytunnel (35 m x 8.5 m) and provided with drip irrigation. At 10% bloom, plants received spore inoculum of the grey-mould fungus, to promote the occurrence of the disease and on separate days, sprayed with one of five commercial BCAs (Table 1), or a chemical fungicide, Rovral; appropriate controls were included. Two harvests were conducted, approximately ten weeks after planting. Total, marketable and diseased fruit yield were recorded. In the case of diseased fruit, the causal organism was identified.

Results

Total yield for each treatment as well as marketable yield and diseased fruit yield are given in Table 1. On average, each bag containing 10 plants yielded over 1.0 kg of fruit, the only exception being one of the controls. In terms of marketable yield, Rovral-treated plants produced most fruit with a mean marketable yield of 1.01 kg fresh weight (Table 1). BCA-treated plants yielded well, with marketable yields of 794 g in the Trichodex treatment to 975 g in the Serenade treatment. Among the BCA-treated plants, no significant differences in marketable fruit yield were noted between treatments.

When the diseased fruit were collected and identified, the vast majority of fruit was affected by the grey-mould fungus, making further distinctions unnecessary. With regard to the incidence of diseased fruit, the lowest values were recorded from plants sprayed with the chemical fungicide, Rovral (Table 1). The level of disease control using Rovral was significantly different to the untreated control, but was not statistically different to the BCA-treated plants, with one exception. The exception was those plants receiving the BCA Messenger, which had *ca* 240 g of fruit contaminated with fungal growth, a fresh weight equivalent to 20% of the total yield from the plants. Poor performance of Messenger was attributed to a lack of protection of the fruit unlike the other formulations.

Table 1. Total yield, marketable yield and diseased fruit fresh weights (g). Each value is the mean of six replicate bags each containing ten plants. Values in the same column proceeded by * are significantly different to the other treatments ($P>0.05$).

Treatment	**Fresh weight (g)**			
	Total yield	***Marketable yield***	***Diseased fruit***	***% of total yield***
Uninoculated-untreated	1065.2	941.3	123.8	11

Untreated	845.8*	717.8*	128.0	14
Rovral	1112.1	1029.8	82.8	7
Serenade	1108.2	975.7	132.5	12
Trichospray	1147.2	968.7	178.5	15
Trianum-P	977.3	848.3	129.0	13
Trichodex	909.0	794.0	115.0	13
Messenger	1214.8	970.3	244.5*	20

Although marketable yield and disease control were comparable to fungicide and BCA treatments, Serenade-treated plants were deemed unsuitable due to the presence of a white powdery residue on the fruit surface. Tests showed that this residue was the Serenade formulation persisting on the fruits. Apart from this, none of the BCA-treated plants produced visually irregular fruits.

Conclusions

From this preliminary trial, it was concluded that certain BCAs could control grey-mould disease of fruit in strawberry grown under protection. The level of control achieved was comparable to that with the chemical fungicide used. Furthermore, no negative effects on marketable yield were recorded with BCA usage. Therefore, it is reasonable to conclude that the BCAs could potentially replace, or at least reduce, the use of chemical fungicides in protected strawberry production systems.

Additional trials to verify these results and build on them are underway at the Teagasc research centre in Oak Park, Co. Carlow. These trials will use tunnels covered with light modifying polythene covers to further enhance disease suppression. In addition, outdoor trials are also being conducted with BCAs alone and in accordance with decision support systems.

New advances in soft fruit protective structures

Mr.Robert Collins

Haygrove Tunnels,

Redbank Farm, Ledbury, Herefordshire, United Kingdom

Delivering continuity of grade one produce to the end consumer is the mission of every fruit, vegetable and flower grower. It was this mission in mind that one grower in the United Kingdom set out in the mid-nineties to try to find a low cost solution to problems that be-devil every grower, the weather! Fed up with rain-affected produce, variable quality and a short peaky season that bought production just at the time when the market is flooded with local low price produce there was certainly a need to find an answer.

'Our major aim at the time', explains Robert Collins, Sales and Service Manager of Haygrove Tunnels, 'was to get some continuity of supply to meet our marketing programmes. The outcome after a few years of testing was to design a low cost tunnel system that we could afford to build over many acres, drive tractors through and manage in high winds, sometimes which gust to 70 + mph.'

The outcome was the creation of the Haygrove Tunnel. A moveable multi-bay structure the Haygrove is big, built from anywhere between 5.5m (18') to 8.5m (28') wide and between 3.5m (11.5') and 4.5m (15') tall the tunnel is designed to take any commercial field scale tractor.

The impact on the UK grower community has been pretty spectacular with over 4000 acres of Haygrove Tunnels built in the last 5 years covering small fruit, cherries, plums, flowers, herbs, ornamentals, tomatoes, peppers and some high value vegetable crops. 'From our initial aim of driving up produce quality and delivering better continuity to our end customer, there have been some very significant other benefits,' explains Robert.

'Most notably has been the impact that the tunnel system has made on season extension. For example with strawberries, we are now picking between 2-3 weeks earlier in the spring and it has also meant that the industry has been able to embrace the late summer and autumn soft fruit and flower varieties. For example, the growth in the strawberry autumn bearer crop has been phenomenal with 50% of planting now picking from August through to November. This industry was just not there 6 or 7 years ago,' explains Robert.
In terms of produce quality the results have also been commercially very important. With soft fruit the grade out percentage of Class 1 versus 2 has been around 90:10 under Haygrove Tunnels compared to 75:25 with conventional outdoor production. In terms of yield, raspberry, strawberry and blueberry class one yields have consistently been 30% higher when protected under a Haygrove Tunnel compared to outdoor production

The tunnels have all shown up other benefits; guaranteed harvest days, guaranteed spray days, significant reductions in moisture related diseases such as *botrytis* and most of all a significant improved ability to deliver marketing programmes.

The results of the work done are summarised in the following table:

Issue	**Impact**	**Examples**
Earliness	Tunnels enclosed using side skirts, door ends, floating row cover and polythene closed for	2-3 weeks earlier with early season strawberries

	maximum earliness	
Season extension	Tunnel polythene drawn down to remove impact of rain	Continues picking of fall strawberries, raspberries through to early Nov in UK. Prolonged picking of late season summer flowers
Class One %	Tunnels enclosed in early season to protect blossom and reduce miss-shaped produce. Vents opened high on warm days to avoid soft growth	Class one % improved by 15% to 20% for small berries compared to outdoor production
Yield	Crop environment managed through venting the tunnels to optimise temperature and humidity	Class 1 Yield budgeted up to 30% better in small berries (34% for raspberries)
Disease pressure	Significant reductions in moisture related diseases. Dry weather diseases such as powdery mildew require improved observation	Significant decreases in *botrytis* and black spot
Weather protection	Guaranteed window to conduct production and harvest routines	No stopping pickers when it rains!

Economic Impact

Ultimately the rapid uptake in multi-bay tunnels in UK and Western Europe has been due to the payback that the growers have received in additional revenues from the system. The following table details the commercial data recorded on an early season strawberry crop in the UK. This data represents the average yield and quality impact on a strawberry crop in the UK.

	Tunnelled	**Outdoors**	**Difference**
Total yield per acre	9.26t	8.11t	+14%
Class 1 %	87%	73%	
Total class 1 yield per acre	8.05t	5.92t	+34%
Picking date	20% of fruit picked 14 days earlier		
Total income ($) per acre	$40,180	$30,752	+31%

Prices:	Class 1	Class 2
Early season (per lb.)	$2.48	$0.87
Main season (per LB)	$1.90	$0.78

The importance of tunnel management

The evidence for low cost, multi-bay tunnels is now pretty conclusive, but just like irrigation, tunnels need managing and integrating into the production plan. Robert Collins goes onto explain; 'Haygroves are designed to be temporary low cost structures that can be moved with the crop. This flexibility means they need be managed. You cannot treat them like permanent greenhouses where they are constructed and then left largely alone'.

'The key management task is venting', says Robert. 'Unlike conventional single hoop houses, multi bay tunnels can be completely opened to ensure the crop is not stressed by heat or humidity. This is a vital management task that needs to be tackled. At Haygrove, where we have 90 ha (220 acres) of multi-bay tunnels we have appointed a designated tunnel manager and her task is to ensure the tunnel vents are lifted or closed depending on the prevailing weather conditions'.

The tunnel vents are also used to manage high winds and the tunnel structures are successfully managed with winds up to 110 kph (70 mph). Over this wind speed the polythene needs to be removed and tied into the leg row.

In terms of construction time growers need to budget on 365 man-hours per ha (150 man-hours per acre). Growers get very fast at building and moving the tunnels and Haygrove have continuously launched new innovations to speed the time to build and manage. For example in 2003, Haygrove launched a new rope clamp that reduced the time take to put the polythene over the tunnel by about half saving some 45 man hours per ha (18 man hours per acre).

'We have leant an awful amount in the last 10 years', concludes Robert, 'the somewhat conflicting objectives of producing a low cost temporary structure that is fast to construct, flexible to close for earliness and open in mid summer and to withstand high winds has been a huge learning experience. We are still learning and we welcome all Haygrove customers to the farm to view the latest ideas!'

Footnote:

Haygrove are growers, growing strawberries, raspberries, cherries, lilies and sunflowers for supermarkets in Great Britain. We introduced field scale multi-bay tunnels in 1993 and started selling them to other growers in 1996. Year-on-year we develop new concepts and solutions to our own and customer's problems, testing them first on Haygrove's farms, before launching them for sale.

The production of strawberry plants to meet today's requirements

Dr.Eamonn Kehoe, Teagasc Soft Fruit Adviser

Teagasc, Dublin Rd, Enniscorthy, Co.Wexford, Ireland.

Irish strawberry growers import the vast majority of their strawberry plants from both the Netherlands and the United Kingdom each year. I visited the Netherlands to take a closer look at their plant propagation practices.

Challenge for Irish propagation

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, the season runs from April, right up to November. Unfortunately, the Irish strawberry propagators can only supply plants for the early part of the fruit season. All of these are lifted in early winter and planted mostly for field production. However, plants for use in protected cropping, must be given a cold store treatment (vernalisation) before planting. Plants required for fruit production later in the season, must also be held in cold store up to 60-days before been planted for fruit production. In Ireland, we do not have the proper cold store facilities, to carry out any of these measures, thus further justifying the importation of plants. This is a challenge for the Irish strawberry propagator(s).

In Holland, a number of the big strawberry propagators are located in the south of the country, near the city of Eindhoven.The Dutch are the largest plant producers in Europe and export their strawberry plants to most Western European countries. They are blessed with a deep, fertile, black sandy soil, which is absolutely ideal for good plant development. Constant summer temperatures and high light levels allow for good uniform crown development, which is crucial, for optimal fruit yield.

While the Dutch specialise in the propagation of a number of different types of strawberry plant, the Dutch variety 'Elsanta' is the mainstay. In fact, this was bred in 1975, between a cross of the two strawberry varieties 'Gorella' and 'Holiday'. The fruit is still the number one choice amongst the western European palate, due to its lovely flavour and juicy nature. There is yet, no real successor to 'Elsanta'.

'Waiting bed' plants

There are many different types of 'Elsanta' strawberry plants produced. The one a grower uses depends very much on the type of cropping system in use. The Dutch are renowned for the production of fresh 'waiting bed' plants. These are large multicrowned strawberry plants. In essence they are produced from fresh plants which are lifted, but replanted again into new beds in early August. They are given extra space in these beds, to allow for large final crown size. High summer temperatures are balanced by careful irrigation by overhead sprinklers. These plants, although more expensive, give much higher yields and are used for mid-Summer field production or, in trough like production systems. They are generally not suitable for peat bag fruit production, due to their large size

In Holland, 'waiting bed' plants are generally the first plants to be lifted from the ground. This takes place in late November. This is because they are more prone to frost damage as they have less leaf cover for protection. If a heavy frost is forecast, growers cover all their plants with either perforated polythene or fleece. One grower for instance, has to cover over 50 hectares of ground! Close attention to the weather forecast is vital. Plant harvesting is accomplished by using huge mechanical lifters, which are capable of lifting up to 50,000 plants in a two-hour period!

'A+' plants

Although some Irish growers use 'waiting bed' plants, we mostly use a smaller type of strawberry plant, known in the trade as an 'A+'. These have a minimum crown diameter of 15mm. Mother-plants are planted in the autumn and then covered in plastic for the winter period. The following Spring, the mother plant produces runners, which grow into saleable plants. Later in the summer, some propagators mow off the leaves to encourage full penetration of light into the plants. According to them, this allows for optimal crown development. In August, the Mother plant is destroyed and the daughter plants are also severed from each other to promote individual crown development. Compact plants with good crown size and even distribution of scaffold and fibrous roots is the primary goal. In Holland, all plants will be harvested by Christmas or mid-January. They are then graded, given an initial cold store treatment to reduce any 'field heat' for 48 hours, and a final treatment of -1.7 °C in huge cold stores, for usually a minimum of four weeks. Growers will then take their delivery of plants depending on whether they are intended for spring, summer or autumn cropping.

'Tray plant' production

'Tray plant' production is also big business in the Netherlands. These are plants that are used mainly by glasshouse growers for spring, summer and autumn cropping. These plants are more suited for glasshouse cropping than the plant types already mentioned. This is because the 'tray plant' is able to cope with the hotter conditions experienced in a glasshouse environment. 'Tray plants' are again produced from runners, which a mother plant produces in the spring. Tips are cut from these runners and are stuck into modular peat trays. One particular grower, Geert de Weert, from Rossum, could plant 150,000 runner tips a day! This is accomplished by using five staff members that plant, lying face down on a gantry like system, which is moved over the peat filled trays. Geert, is very well known in both Dutch and European Horticultural circles. Aswell as being a top class propagator and fruit producer, he also conducts important trials for the industry. In total, he produces about 800,000 tray plants per year.

The need for a good final crown size and an evenly distributed and firm root system was emphasised by de Weert. His tray plants are also grown at a higher planting density than the Dutch norm, which in his opinion 'allows for a more compact plant'. While the vast majority of tray plant producers use black coloured trays he opts for 'white'. He is adamant, that a white tray allows for cooler compost for the plant in the peak of summer. It also allows for

maximum light penetration into the plant crown in the autumn time, which is vital for further crown development and good flower initiation.

He also pointed out that old senesced leaves should not be removed from the plant at grading, which is also the norm. In his opinion, removing these leaves wounds the plant, leaving it more prone to infection. The final size of the plant crown can also be a misleading concept. A large crown size doesn't always guarantee a high yield. Many of the smaller tray plants he grows and uses himself can often give the best fruit yield.

To test the theory of 'tray plant' use under glass, we visited one-such glasshouse grower. This grower was able to achieve a yield of almost 14-kg of fruit over two seasons from a planting density of 10 plants per m^2. This yield was achievable with the benefit of better climatic conditions than our own, but also the use of clean modern heated glass, night-break lighting, CO_2 supplementation, and very good crop husbandry. Very few pesticides were used with biological control being used to combat any insect pests. In total the grower was able to achieve a staggering yield with 90 percent Class 1 quality!

A top class raspberry plant

Geert also propagates 'Polka' the new Autumn fruiting primocane raspberry in association with Hargreaves Plants in the UK. The beauty with this variety is that it fruits earlier than 'Autumn Bliss', has an excellent size, flavour, and fantastic shelf life. Grey mould (*Botrytis cinerea*) is not a problem, and biological control of Red spider mite (*Tetranychus urticae*) is easy, as the plant has a large and smooth leaf surface allowing the predators to roam quickly and easily for their prey. He is also 'double cropping' the variety, resulting in a much longer cropping season. CO_2 supplementation is also used to boost crop growth and yield. Although 'Polka' is of Polish origin, it amazingly, has a very low requirement for cold (vernalisation), to yield properly, making it very suitable for cropping in Ireland.

Message for Irish Growers

After visiting these fruit propagators the message is clear for Irish soft fruit growers. Individual growers are spending many thousands of Euro each year on imported strawberry plants. Quality is often questionable, when the crates are opened upon delivery. The only way to know exactly what you are buying is to go and see the plants for yourself. The quality of plants changes from year to year, with each propagator, due to different propagation sites etc. If the quality of plant is poor, yields and profitability will be greatly reduced. Most propagators are only too delighted to see their customers each year. Building up a good relationship with your plant propagator is crucial. This will improve the prospects of actually receiving the plant quality that you expect and require.

Mr.Gary McCathy

Chairman

McCarthys Fruit Farm, Daars, Sallins, Co.Kildare

The idea of an Irish Soft Fruit Growers Association was first discussed in 1999 on a bus in Holland, when a group of growers were on an educational trip. Previous to this, growers in different regions of the country rarely met each other, and it was in the relaxed environment of a few days away, that we all realised we should cooperate to each other's benefit.

Growers in the Dublin, Meath and Kildare had started growing strawberries and raspberries in glasshouses and polytunnels. With less history of soft fruit production these growers could benefit from the knowledge gained from two generations of fruit production in Wexford.

At the same time Wexford and midlands growers realised it was necessary to extend the Irish soft fruit season to deliver the continuity of service the supermarkets now required. Protected cropping was the answer and they could use the experience gained by North Leinster growers over the years in the production of tomatoes, lettuce and cucumbers.

The ethos of co-operation was formalised under the guidance of both Teagasc and Bord Glas with the formation of "The Irish Soft Fruit Growers Association" (ISFGA) in November 2000.

The aims of our association are as follows.

(1) To increase the consumption of Irish Soft Fruit both major and minor and following on from that, to increase production in line with demand.

(2) To continuously raise the standard and quality of all producers through the "Bord Glas (NSAI) Quality Assurance Scheme".

(3) To reduce the peaks and troughs of supply both nationally and locally through greater planning, and co-operation between growers and retailers.

(4) To control increasing production costs as far as possible through greater efficiency and industry best practise.

(5) To promote an ethos of continuous improvement in production and co-operation.

Since the formation of our association the committee members have worked tirelessly to improve our industry. We have enjoyed considerable success along the way with just some of our achievements as follows.

(A) Our trip to Huelva in Spain organised by the committee and Dr. Eamonn Kehoe (Teagasc).

(B) Seminars organised for us by National Agricultural Chemicals, to educate and inform us on the developments of environmentally friendly, chemical and biological pest and disease controls.

(C) We successfully lobbied The Dept of Trade and Enterprise with the help of the I.F.A. to allow growers continue to use foreign labour with work permits until May 2004 when many other industries were denied this.

(D) For the last number of years we have been actively involved with the Bord Glas fruit promotions

(E) This conference is been organised by the ISFGA and Teagasc with sponsorship from Bord Glas.

As time goes on we find we are achieving more each year. We are now the first port of call for anyone who wants to get the view or work with Irish soft fruit growers. We are continually in contact with the IFA, Bord Glas, Teagasc, and the Department of Agriculture on grower's behalf.

I would like to take this opportunity to thank everyone who has helped us along the way including Teagasc, Bord Glas, Dept of Agriculture, IFA, Retailers, our Suppliers and especially the growers, who trust myself and the committee to look after their interests. We include an application form for any growers who wish to join our association.

Yours Sincerely

Gary Mc Carthy

Chairman

Module Grown Strawberry Nutrition Programme

Patrick Murphy

Boro Valley Fruits

Ballymackessy Cross, Enniscorthy, Co.Wexford

The water analysis indicates soft water, with no need to add any acid. The calcium level in the water is very low (8 mg/l). This means extra calcium must be added to the water, or strawberries of poor shelf life will result.

Levels of sodium, chloride and the overall conductivity, is low. This indicates that the water is a suitable water supply for fertigating strawberries. The level of trace elements in the water is low and can be ignored.

To correct the low calcium level, 12 kg of Calcium nitrate was added to a separate tank and 200 litres of water added. This was diluted to 1:100, using a separate in-line Dosatron. Never add the Calcium nitrate to the main feed tank, or a sludge of calcium sulphate will form!! The additional calcium nitrate will supply 114mg/l calcium, giving a total of 122mg/l including the water supply. The target is around 100-120 mg/litre calcium.

The second tank (main feed tank) contains 13.5 kg of 7-6.3-34 hydroponic feed and 2.0 kg of 10-52-17 feed. This is also made up to 200 litres. At green fruit stage onwards the 7-6.3-34 feed is increased to 16.0 kg per 100 litres of mix, keeping the 10-52-17 feed constant. This gives 149-mg/l nitrate-N during the main fruiting stage. The Kinsealy target level of nitrate-N for module grown strawberries is 150 mg/l.

During picking stage 2.0 kg of potassium sulphate is added to the main feed tank. This is known to improve fruit flavour.

A runoff of 25% is the target during the main growing phase of the crop. If the input from 2 drippers is measured, and the output from 8 drippers is also measured, and the volumes are the same, then this equals to 25% runoff.

Water sample: P Murphy

Analytical results

Test	**Water Result (mg/l)**	**Test**	**Water Result (mg/l)**
pH	6.4	EC	175 uS/cm
Phosphorus	0.1	Sulphate	9.9
Potassium	<1	Boron	<0.01
Calcium	***8.2***	Copper	<0.01
Magnesium	9.6	Manganese	<0.01
Nitrate-N	6.2	Zinc	0.02
		Iron	<0.01

Iron	<0.01	Carbonate	<0.1
Sodium	12.3	HCO3	28.5
Boron	<0.01		
Chloride	19.3		