Production Guidelines- Malling Centenary

Introduction

Malling Centenary (MC) is a relatively new Junebearing Strawberry cultivar from Meiosis with excellent fruit quality and lower harvest cost potential, compared to the industry standard varieties Elsanta and Sonata. It was bred in the UK by the strawberry breeding team at NIAB EMR in East Malling, Kent. Its first commercial release was in 2013.

Malling Centenary's most obvious advantages are:

- **Larger fruit size** (Average Berry weight typically 18-22g, compared to 13-15g for Elsanta).
- **Low level of misshapes** (Typically 95% Class 1 compared to 75-80% for Elsanta).
- **Faster picking** (picking speeds of 30-40 kg/hr are common compared to 25-30 kg/hr for Elsanta - on Table tops).
- **Attractive fruit with good colour and superior shelf life** compared to many alternatives.

Figure 1. Fruit Quality characteristics of Malling Centenary

These attributes have led to the variety becoming popular with growers and multiple retailers in the UK, where it has established itself as a preferred variety. The variety has also performed well in Belgium, Holland and Germany, and despite the dominance of Elsanta in these markets, many continental growers are beginning to switch.

In agronomic terms, MC commences harvest a few days earlier than Elsanta, with a more pronounced and concentrated early peak, but a longer picking period overall. The long production tail of MC has the potential to reduce profitability if not well managed.

Under glasshouse and permanent polythene structures, a mid-summer crop is possible in addition to the standard Autumn and Spring production. The mid-summer crop comes from spring-initiated flowers, but is contingent on the total amount of chill received by plants being controlled. This middle crop allows expensive glass to be utilised for production over a longer growing season, rather than lying empty between spring and autumn crops, significantly increasing the total harvested kilos per sq m, which can be an advantage if the additional yield can be sold at a profit.

Thus, Malling Centenary sets new standards for fruit quality and low harvest cost compared to industry standard varieties, and offers additional agronomic benefits. However, notwithstanding its great potential, Malling Centenary does present a number of challenges, which need to be understood and controlled, in order to get the best from this variety and make the most of its potential.

Malling Centenary's main challenges are:

- Increased susceptibility to Crown Rot, which poses a challenge to plant propagators to produce clean material for fruit growers.
- A slightly weaker and less fibrous root system compared to many other commercial varieties, which can lead to slower plant establishment and lower root pressure, which in turn increases the risk of tip and calyx burn.
- Despite its better fruit size and shelf life characteristics MC can suffer from low Brix, especially when plants are heavily loaded with fruit.
- Finally, since MC initiates flower more easily and under less stringent environmental conditions than Elsanta, pre-flower and lack of flower initiation uniformity in propagation can be an issue.

Propagation, establishment, feeding, irrigation and Crop Protection strategies are substantially different for Malling Centenary, compared to Elsanta. These production guidelines, produced by Delphy UK for Meiosis, will cover some of these issues in order to help producers get the most from this exciting variety and to fully realise the commercial opportunity it presents to the Soft Fruit Industry.

Plant Physiology

Malling Centenary is a short-day cultivar with relatively high chill requirement. Research at PC Fruit Hoogstraten, Belgium found that 1512 Chill Units gave optimal yield in overwintered crops, broadly similar to Sonata and roughly 50% more than Elsanta (1).

Photoperiodic control of flowering in MC is weaker than in Elsanta, and the variety will readily initiate flowers under non-inductive conditions for Elsanta, if plants are subject to periods of mid-summer stress. This often results in the emergence of flower trusses in late autumn (pre-flowers) in the propagation/production field, which produce no useful yield.

Due to its relatively high chill requirement, Malling Centenary is a tricky variety to overwinter under glass and under polythene in milder areas of NW Europe, without the use of night-break lighting during early spring. Unlit plants with insufficient chill produce short trusses and compact leaf canopy, with a higher proportion of misshapen fruits and smaller fruit size to give sufficient leaf and truss stretch for optimal cropping.

Plant Establishment for Fruit Production

Establishment of bare root or tray plant MC is easier during cooler conditions in the early part of the year. Moderate temperatures and slower initial growth promote good plant establishment. Removing pre-flower (i.e. any open flower expressed within 5000 GDH of planting) helps to minimise plant stress and to promote better establishment.

For summer planting, tip burn and calyx burn are major issues and can lead to the loss of many flowers or even whole trusses (see Fig 2). It is not uncommon to see summer planted MC with poor/slow root development but a lot of emerged leaf and trusses. The weaker root system of MC coupled with high transpiration demand from developing leaves means that it becomes difficult to maintain sufficient root pressure to prevent tip burn, especially under conditions of extreme heat and/or humidity.

Choosing a more moisture retentive substrate can help in terms of establishing summer planted MC. In very free-draining substrates, MC needs very frequent drip cycles in order to prevent the substrate drying under conditions of high ET demand. Late evening (or even night) watering in very warm conditions, or vent shutdown after dark (to build humidity) can boost root pressure and help prevent tip and calyx burn. During sunny daytime conditions, sprinkling floors to maintain RH @ 60-75% reduces the tip burn risk. As mentioned above, it is best to avoid overhead sprinkling of MC during plant establishment due to the increased Crown Rot risk.

Figure 2. Severe tip and calyx burn in Malling Centenary

The incidence of tipburn is increased if the growing substrate has high EC, due to high levels of Base Fertilizer, or in the case of Coir substrates is inadequately washed and buffered (see nutrition notes below).

Plant Management and Fruit Production

Malling Centenary leaf area is generally lower than for Elsanta, so little de-leafing is required in the first crop. In overwintered crops, more crowns are required to achieve high yields, due to lower flower numbers per truss (Aim for 35-40 crowns/m with MC, rather than 24-26/m for Elsanta). Higher crown number leads to a denser canopy which increases the risk of Botrytis. In order to decrease Botrytis risk, it is important to remove short leaves around the base of crowns and pull trusses out from the leaf canopy. Truss pulling also helps to minimise misshapes caused by poor pollination, and calyx burn due to insufficient airflow round developing fruits.

In the early and late parts of the year, MC is more Botrytis susceptible than Elsanta due to its more upright flower trapping moisture and remaining wet for longer. Good climate management is required in order to control this (e.g. additional venting and pipe heat during the flower period). MC also benefits from slightly higher temperature settings than Elsanta in the early and late parts of the year in order to promote early root activity and (especially later Autumn) maintain fruit ripening.

Trusses on cold stored MC plants tend to be longer than those of Elsanta, and are more prone to kinking. To minimise truss kinking, the truss support tape needs to be moved further up and out compared to Elsanta. Truss pulling needs to be done on time with MC before they become too long, in order to avoid unnecessary breakage.

Although MC requires higher crown numbers than Elsanta, some de-crowning may be required for over-wintered or Spring planted crops being kept for another year. Due to the higher crown rot susceptibility of MC, it is better to start de-crowning operations earlier in summer (July – immediately post-harvest). Aim to leave 2 crowns/plant. Additional de-crowning can be done the following year, prior to truss emergence, as required.

Autumn and Spring cropping MC generally gives a peakier production profile than Elsanta, with very high kg per sq m picks in the first few weeks of production (see Figs 3 & 4). Simple trusses and large, heavy fruit during this early peak allow for good margins and profitable production. Later production is slower in MC compared to Elsanta which shows a more evenly spread production profile.

An exception to the normal peaky MC profile is the mid-summer crop (second flush from spring flower initiation on partially chilled plants – see Fig 4). This has a more even profile and lower pick volumes throughout. Given the timing and profile of the middle crop, producers should consider margins vs the cost of leaving glass un-occupied. The advantages of the summer crop include no extra establishment cost and increased total annual yield from glass.

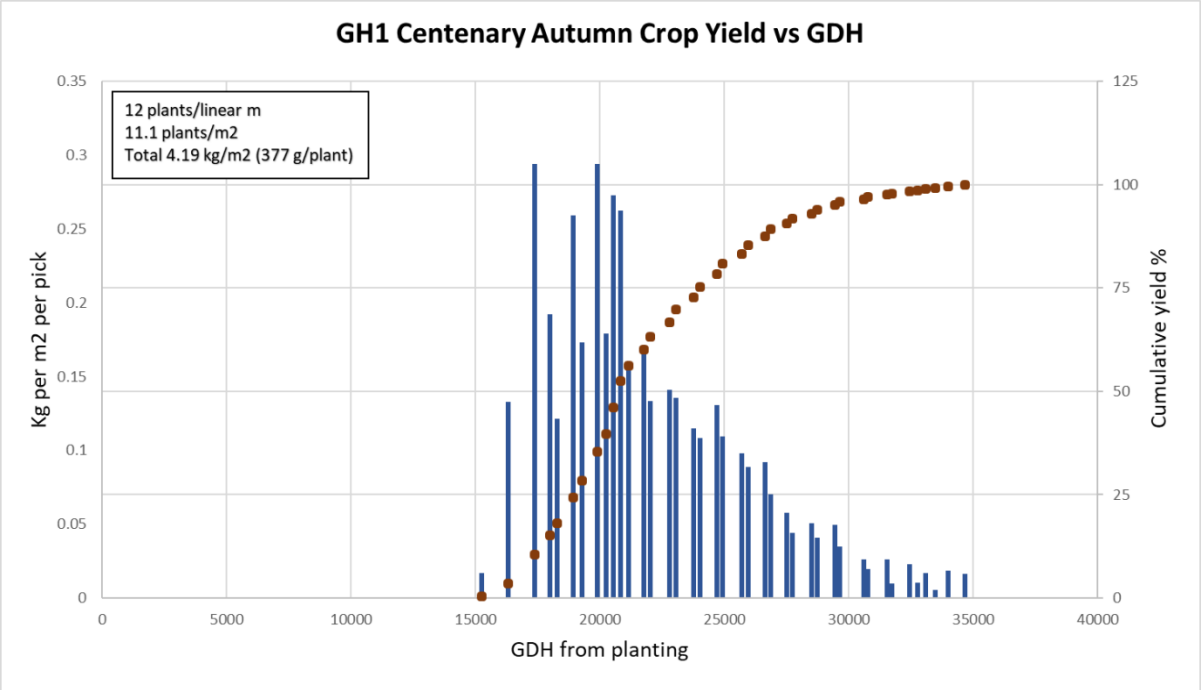

Figure 3. Malling Centenary Autumn Picking Profile – 2016 (Data courtesy of Nick Evans, Haygrove Sidlesham)

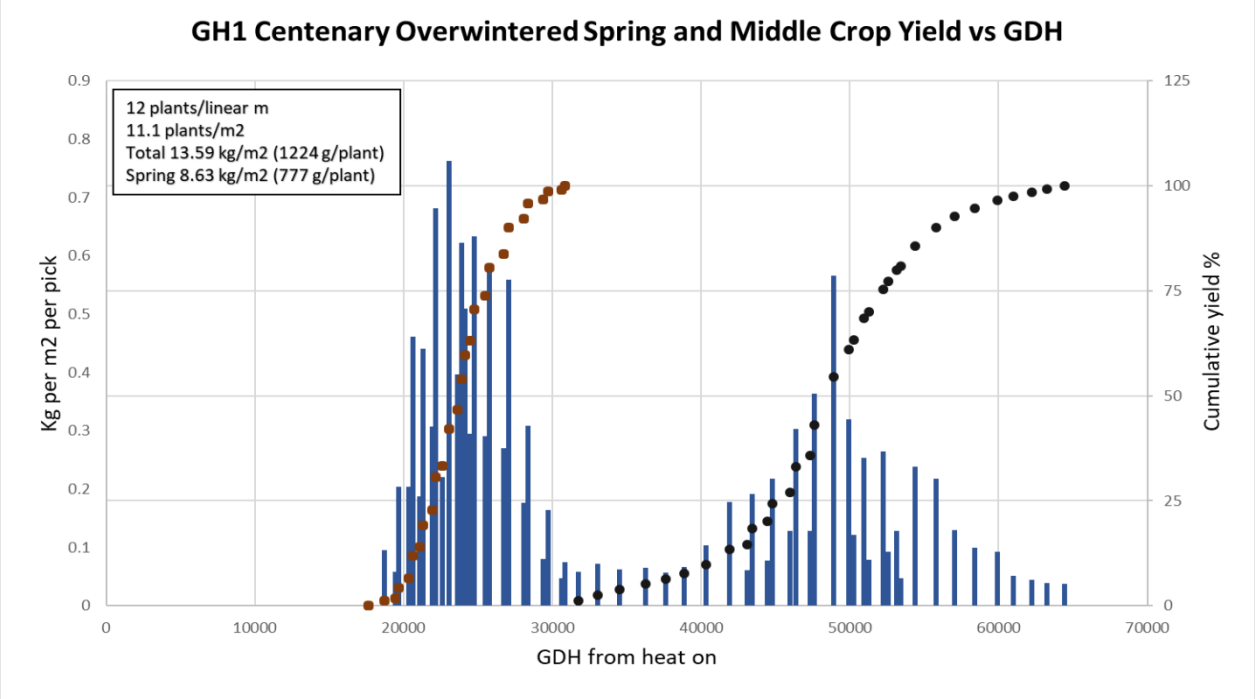

Figure 4. Malling Centenary Overwintered Spring and Middle Crop Picking Profiles - 2017 (Data courtesy of Nick Evans, Haygrove Sidlesham).

Chill Requirement and Manipulation for Mid-Summer Crop

Malling Centenary is a high chill cv, requiring at least 1512 chill units for optimal yield (1). MC plants overwintered in milder areas or under glass may receive less than this level of chill in many winters, and so need night-break lighting in order to give sufficient leaf and truss stretch for optimal cropping. Partly chilled plants are, however, able to initiate additional trusses under favourable environmental conditions. For example, under glass in the UK flower initiation can occur from Feb-April giving a mid-summer crop (second flush) crop generally lasting from June-August.

This phenomenon can also occur in partly chilled Elsanta plants. However, unlike Elsanta and several other Junebearing cv's, fruit quality of the mid-summer crop from MC is excellent (see Fig 5), and commercial yields can exceed 4 kg sq m. If chill is carefully managed, the second flush can follow the first crop very closely, with little or no gap in picking. In order to achieve the second crop from overwintered or short cold-stored MC plants, aim for 600-800 chill units and give 30-40 nights of night break lighting in order to achieve sufficient stretch in the Spring crop. Unlike Elsanta, MC doesn't produce elongated ("bottle-shaped") fruit, if too much night-break lighting is given.

If plants receive more than 800 Chill Units, spring flower initiation may be delayed, giving a gap between flushes and a lower summer crop. If plants receive more than 1200 chill units then Spring flower initiation is strongly inhibited and little or no middle/Summer crop is produced.

Figure 5. Malling Centenary middle/Summer crop

Nutrition

In order to minimise tip and calyx burn during establishment, Malling Centenary starter feed recipes have a higher initial Ca requirement than Elsanta. It is important to plant MC into well buffered coir substrate. If pre-plant Barium Chloride test shows insufficiently buffered substrate (i.e. containing too much Potassium and/or Sodium and insufficient Calcium), it is important to re-buffer with additional Calcium Nitrate solution and to thoroughly wash the substrate afterwards to ensure the EC of drain water is <1.5 mS. Additionally, the Starter feed K/Ca ratio should be in the range 0.75-0.9 during the establishment phase of MC.

Overall K requirement for MC during the fruiting phase is similar to Elsanta, but due to its peakier crop profile, K demand during fruit swell and during early picking is higher (K/Ca = 2.0-2.5). Due to a more rapid tail off in picking volumes with MC compared to Elsanta, it is important to reduce K/Ca to 1.5 at 65% pick, especially if a middle crop is being grown in order to reduce calyx burn on developing flowers. Post-harvest, aim to bring K/Ca to 1.0.

For spring crop (or 60 Day) plants grown in the field, if the plan is to over-winter the plants, avoid starving them during the summer period by feeding with too low drip EC. As plants can lose vigour and go into premature flower induction, resulting in late autumn flower emergence (pre-flower).

Drip pH requirement for MC is similar to Elsanta (5.3-5.5). Due to its larger fruit size, EC can be allowed to rise slightly higher. Aim for EC Sum of 2.6-3.0 mS pre-harvest and 3.0-3.4 mS during harvest. EC Sum levels which are too high may result in reduced fruit size and increased calyx burn.

Delphy	NO_3-N	NH_4-N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo	HCO_3	EC feed (mS)	EC sum (mS)	pH
-Vegetative	11.5	0.50	1.3	3.2	4.2	1.5	1.2	35.8	18.2	7.7	13.0	1.9	0.5	0.33	1.56	2.6-3.0	5.5
- Fruiting	11.5	0.25	1.2	6.2	3.0	1.2	1.1	35.8	18.2	7.7	15.7	1.9	0.5	0.33	1.53	3.0-3.4	5.5

Figure 6. Malling Centenary Base Vegetative (Starter) and Fruiting recipes (mmol/L) for Coir Substrate

Crop Protection

A summary of the main issues is given below:

Botrytis - The main risks are infection of flowers during cooler times of year, and crown infections on over-wintered plants. Botrytis crown infections can also occur during propagation, particularly where irrigation is not controlled effectively.

- Flower infections can be minimised by using good climate control, use of minimum pipe in order to dry plants and promote an active climate with good transpiration.
- Avoid wet floors during high risk periods.
- Pull trusses out of the canopy in good time to allow good air movement around flowers and fruits. Do not delay truss pulling.
- Pick clean and remove diseased fruits, particularly from inside the canopy.
- Crown Botrytis can often be a problem and spread to the petioles of older leaves and trusses. Removal of short leaves around the crown can help alleviate this problem by improving airflow.
- Apply strong Botrytis sprays with every spray round from first open flower. Suitable products include those containing: Cyprodinil + Fludioxonil, Pyrimethanil, Boscalid + Pyraclostrobin, Fluopyram + Trifloxystrobin, or Fenpyrazamine.
- Continue to apply zero to 1-day HI Botrytis sprays throughout picking (e.g. Fenhexamid, Bacillus subtilis). Always check product approvals and conditions of use with the relevant local authority before any application.
- Clean around crowns of over-wintered crops to remove trash which can harbour botrytis and other disease-causing organisms. Clean overwintered plants thoroughly in early spring, and apply post-cleaning Botrytis sprays soon afterwards. Avoid crown damage where possible.
- De-crowning, where required, should be done earlier in the year than with Elsanta (i.e. shortly after main-crop harvest). Otherwise, plants can become very dense during the summer months and suffer from severe disease following heavy de-crowning under more humid conditions later in the year.

Mildew – Malling Centenary can be susceptible to Powdery Mildew. The disease tends initially to be more evident on fruit than on leaves.

- Clean overwintering crops thoroughly after winter to remove any inoculum surviving on leaf trash.
- Manage climate and vents to reduce risk where mildew is spotted in the crop, or where other risk factors are present. High temperatures, high Relative Humidity and high wind-speed over the plants can all pre-dispose plants to Powdery Mildew infection.
- Pick clean and remove diseased fruit as soon and they are seen.
- Remove runners promptly where mildew risk is high.
- Apply a robust protectant spray program, based on products containing: Quinoxyfen, Proquinazid, Penconazole, Azoxystrobin + Difenoconazole, Fluxapyroxad + Difenoconazole and Fluopyram + Trifloxystrobin.
- Where Mildew is a problem on fruiting MC, include sprays of Potassium Bicarbonate at 6.0-7.5g/lit (+ wetter) in order to eradicate spores. Follow up with 1-3d HI protectant products (e.g. Fluxapyroxad + Difenoconazole, Fluopyram + Trifloxystrobin, Bupirimate, or Cyflufenamid) where possible.
- Always check approval of products and conditions of use with the relevant authority before any application.

Crown Rot – Malling Centenary is susceptible to both *Phytophthora cactorum* and *Pestalotiopsis clavispora*. Plant losses have been very high on material received from some propagators (up to 30% crown rot) and the prevalence of crown rot disease is a potential threat to the long-term commercial success of MC as a variety.

- For growers: form a good relationship with a plant propagator and visit during the plant production season to look at fields and to talk about plant production and supply.
- Inspect deliveries of plants carefully and grade out any suspected crown rot plants before planting. A rate of crown rot plants greater than 3% represents a problem during production.
- Promptly remove any collapsing plants and count keep a regular count of numbers. An early sign of potential crown rot problems is often lack of early morning guttation in an otherwise fully guttating crop.
- The use of fresh planting substrate is strongly advised, as the risk of disease carry over from previous crops is high when re-using substrate.
- Do not establish plants using overhead irrigation. In hot conditions, use sprinklers under table-tops, or damp down floors, to raise humidity. In glasshouses, use shade screen, roof sprinklers, or apply shading material when establishing in hot summer conditions.
- Apply the full range of available chemicals at plant establishment, i.e. Dimethomorph and Fenamidone + Fosetyl-Al (revocation confirmed end of 2019). Always check approval status of products and conditions of use with the relevant authority before any application.
- Use of plant bio-stimulants, such as Potassium Phosphite, as a foliar feed and occasionally as an addition to the Fertilizer B Tank (@ 5Litres per 1000L) may help strengthen plants against disease.

- Be careful when performing jobs like truss teasing, de-leafing, crown thinning, de-runnering and harvesting. Crown damage can allow entry of pathogens.
- For plant propagators: reduce overhead water by 25% compared to Elsanta.
- For further information, please see the guidelines in this document http://www.berryplantsltd.co.uk/files/7714/8613/2214/Pestalotiopsis.pdf

References

1. Ervaringen met Malling Centenary op een rijtje (2016). K. Stoffels, P. Melis & M. Vervoort, Proefcentrum Hoogstraten, Meerle https://www.proeftuinnieuws.be/wp-content/uploads/2016/11/Ervaringen-met-Malling-Centenary-op-een-rijtje.pdf.
2. Pestalotiopsis Crown Rot in Strawberry- Disease Characteristics and Suggested Management Strategies (2016). R. Marshall & D Wilson, Delphy UK http://www.berryplantsltd.co.uk/files/7714/8613/2214/Pestalotiopsis.pdf

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