



De Ruiter®



Malling™

Centenary

GROWER GUIDELINES



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THE STANDARD FOR STRAWBERRY QUALITY

Welcome to our Malling™ Centenary grower guidelines developed by Malling™ Fruits for growers and propagators, helping you get the very best from our varieties.

‘Malling Centenary’ (formerly ‘EM1764’) was selected at East Malling Research (currently NIAB), UK in 2006 and has a complex pedigree. It has a mid-early season, producing high quality fruit with low waste and reduced picking costs.

Launched in 2013, Malling™ Centenary has set the standard for strawberry quality in the UK. A combination of improved fruit quality, high percentage of Class 1 fruit, together with a significant reduction in picking costs and reduced mark out has led to its rapid uptake by growers and universal acceptance by retailers and consumers.

Malling™ Centenary’s rapid impact to the industry was recognised with the award of ‘Best new fruit variety’ at the Grower of the Year Awards in 2016.

Today, Malling™ Centenary is the most popular Junebearer variety in substrate production across Northern Europe, both glasshouse and in tunnels.

With plant sales reaching 70 million plants annually, the variety is recognized globally for its outstanding fruit quality.

I hope that our guidelines will provide essential reading and top tips to maximise production and I look forward to meeting you at trade events and open days across the season.

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SUMMARY

Malling™ Centenary is a Junebearing strawberry variety with excellent fruit quality and lower harvest cost potential, compared to the industry standard varieties market standard and Sonata. It was bred in the UK by the strawberry breeding team at NIAB in East Malling, Kent, and released commercially in 2013 .

Fruit quality

Malling™ Centenary has excellent overall fruit quality, with firm, attractive berries with very regular shape and excellent flavour. Fruit size is excellent with 60-65% of berries produced being >35mm. This trait, combined with its upright plant habit, good fruit display and high % Class 1, allows for rapid harvesting and reduced picking costs.

Growth habit

This variety has compact plants, with long flower trusses that give excellent fruit display and make picking very easy. Fast picking speeds of up to 40 kg/hour can be achieved in

table-top systems. Early trials data suggests that the variety works well in lower density plantings of 5-6 plants/m.

Production period

Malling™ Centenary is an early-mid season June-bearer, typically cropping four days ahead of market standard variety in the UK.

Growth habit

The variety produces good plants with a similar vigour to standard variety, but with bigger leaves. Malling™ Centenary has faster picking, with speeds of 30-40 kg/hr common on tabletop systems. It is also suitable for glasshouse and protected outside production.

Disease resistance

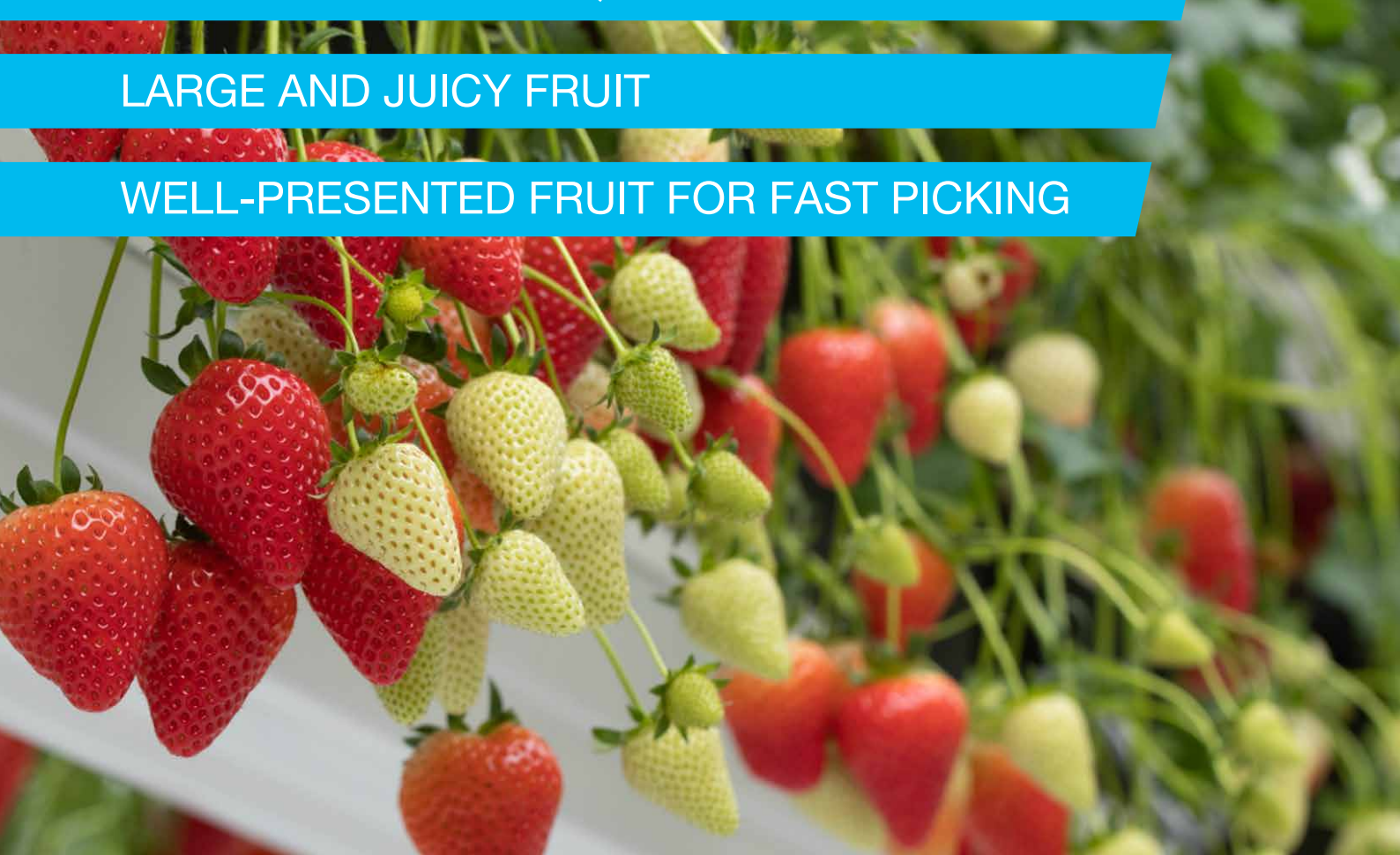
Malling™ Centenary has intermediate resistance to powdery mildew. However, the variety is susceptible to root diseases and this should be considered when selecting production sites and plant treatments.

EARLY-MID SEASON JUNE BEARER

EXCEPTIONAL FRUIT QUALITY

LARGE AND JUICY FRUIT

WELL-PRESENTED FRUIT FOR FAST PICKING



INTRODUCTION

Malling™ Centenary's most obvious advantages are:

- // larger fruit size (average berry weight typically 18-22g, compared to 13-15g for standard variety);
- // low level of misshapes (typically 95% Class 1 compared to 75-80% for standard variety);
- // faster picking (picking speeds of 30-40 kg/hour - on table tops);
- // attractive fruit with good colour and superior shelf life compared to many alternatives.

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. Malling™ Centenary has also performed well in Belgium, The Netherlands and Germany.

In agronomic terms, Malling™ Centenary commences harvest a few days earlier than benchmark variety, with a more pronounced and concentrated early peak, but a longer picking period overall. The long production tail of Malling™ Centenary 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 square metre, which can be an advantage if the additional yield can be sold at a profit.

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, the variety 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.

The main challenges include:

- // increased susceptibility to Crown Rot, which poses a challenge to plant propagators to produce clean material for fruit growers;



Figure 1. Fruit quality characteristics of Malling™ Centenary

- // 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 Malling™ Centenary can suffer from low Brix, especially when plants are heavily loaded with fruit;
- // finally, since Malling™ Centenary initiates flower more easily and under less stringent environmental conditions than benchmark variety, 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 benchmark variety. These production guidelines, originally produced by Delphy UK, 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 variety with relatively high chill requirement. Research at PC Fruit Hoogstraten, Belgium found that 1,512 Chill Units gave optimal yield in overwintered crops, roughly 50% more than market standard. (1).

Photoperiodic control of flowering in Malling™ Centenary is weaker than in market standard, and the variety will readily initiate flowers under non-inductive conditions for market standard, 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 Malling™ Centenary's relatively high chill requirement, it can be challenging to overwinter under glass and under polythene in milder areas of north-west 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.

CULTIVATION PHASE

Plant establishment

Plant densities differ slightly based on the production systems being used. Based on data from almost 10 years of production, plants densities can be:

// 12-14 plants/m² for glasshouse production

// 8-10 plants/m² for tunnel production.

Establishment of bare root or tray plant Malling™ Centenary 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 5,000 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 Figure 2). It is not uncommon to see summer planted Malling™ Centenary with poor/slow root development but a lot of emerged leaf and trusses.

The weaker root system of Malling™ Centenary 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 Malling™ Centenary. In very free-draining substrates, Malling™ Centenary 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 at 60-75% reduces the tip burn risk. As mentioned previously, it is best to avoid overhead sprinkling of Malling™ Centenary during plant establishment due to the increased Crown Rot risk.

Figure 2. Severe tip and calyx burn in Malling™ Centenary



Plant management and fruit production

Malling™ Centenary leaf area is generally lower than for market standard variety, so little de-leaving 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 Malling™ Centenary, rather than 24-26/m for benchmark variety). 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, Malling™ Centenary is more Botrytis susceptible than market standard 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). Malling™ Centenary also benefits from slightly higher temperature settings than benchmark variety 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 Malling™ Centenary plants tend to be longer than those of market standard, and are more prone to kinking. To minimise truss kinking, the truss support tape needs to be moved further up and out compared to market standard. Truss pulling needs to be done on time with Malling™ Centenary before they become too long, in order to avoid unnecessary breakage. Although Malling™ Centenary requires higher crown numbers than market standard, 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 Malling™ Centenary, 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 Malling™ Centenary generally gives a peakier production profile than market standard, with very high kg per square metre picks in the first few weeks of production (Figures 3 and 4). Simple trusses and large, heavy fruit during this early peak allow for good margins and profitable production. Later production is slower in Malling™ Centenary compared to market standard which shows a more evenly spread production profile.

An exception to the normal peaky Malling™ Centenary profile is the mid-summer crop (second flush from spring flower initiation on partially chilled plants – Figure 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.

Chill management

Malling™ Centenary is a high chill variety, requiring at least 1,512 chill units for optimal yield (1). Malling™ Centenary 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 February-April giving a mid-summer crop (second flush) crop generally lasting from June-August.

This phenomenon can also occur in partly chilled market standard plants. However, unlike market standard and several other June bearing varieties, fruit quality of the mid-summer crop from Malling™ Centenary is excellent (Figure 5), and commercial yields can exceed 4 kg/m².

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 Malling™ Centenary 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 Malling™ Centenary does not 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 1,200 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

GH1 Centenary Autumn Crop Yield vs GDH

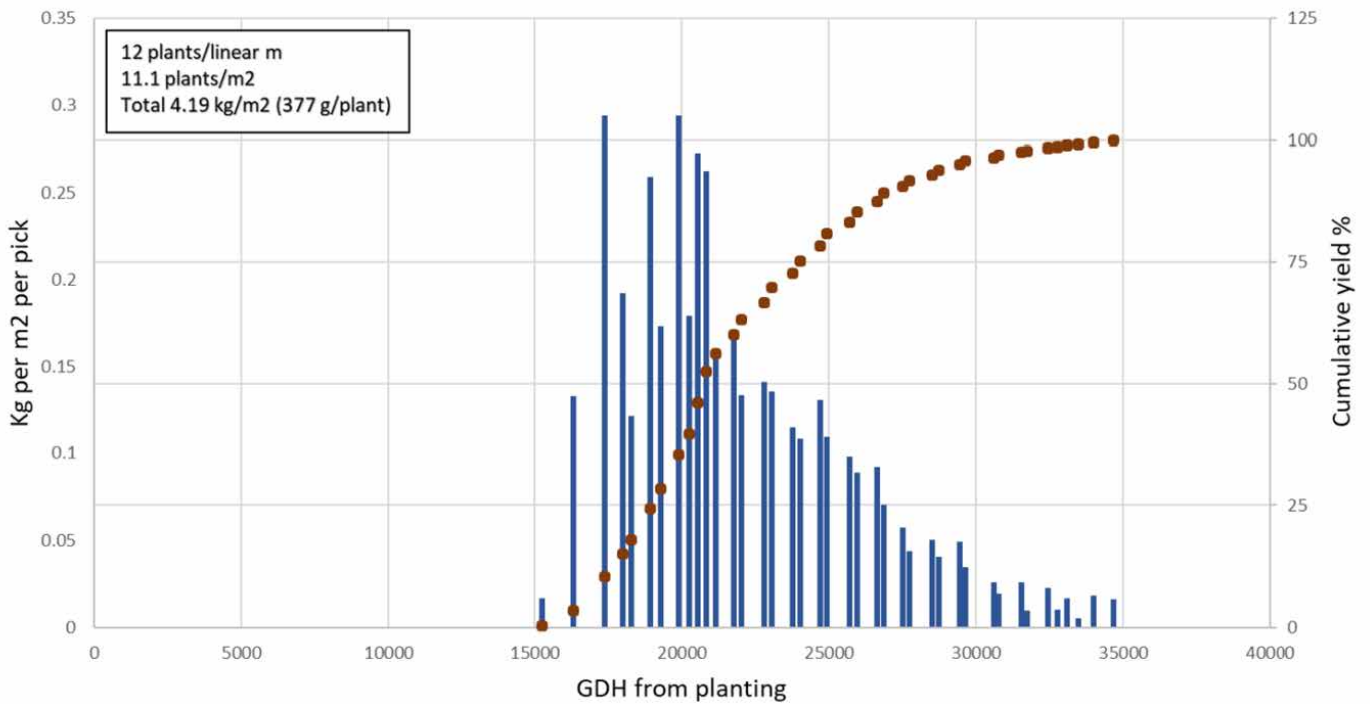


Figure 3. Malling™ Centenary autumn picking profile 2016 (data courtesy of Nick Evans, Haygrove Sidlesham)

GH1 Centenary Overwintered Spring and Middle Crop Yield vs GDH

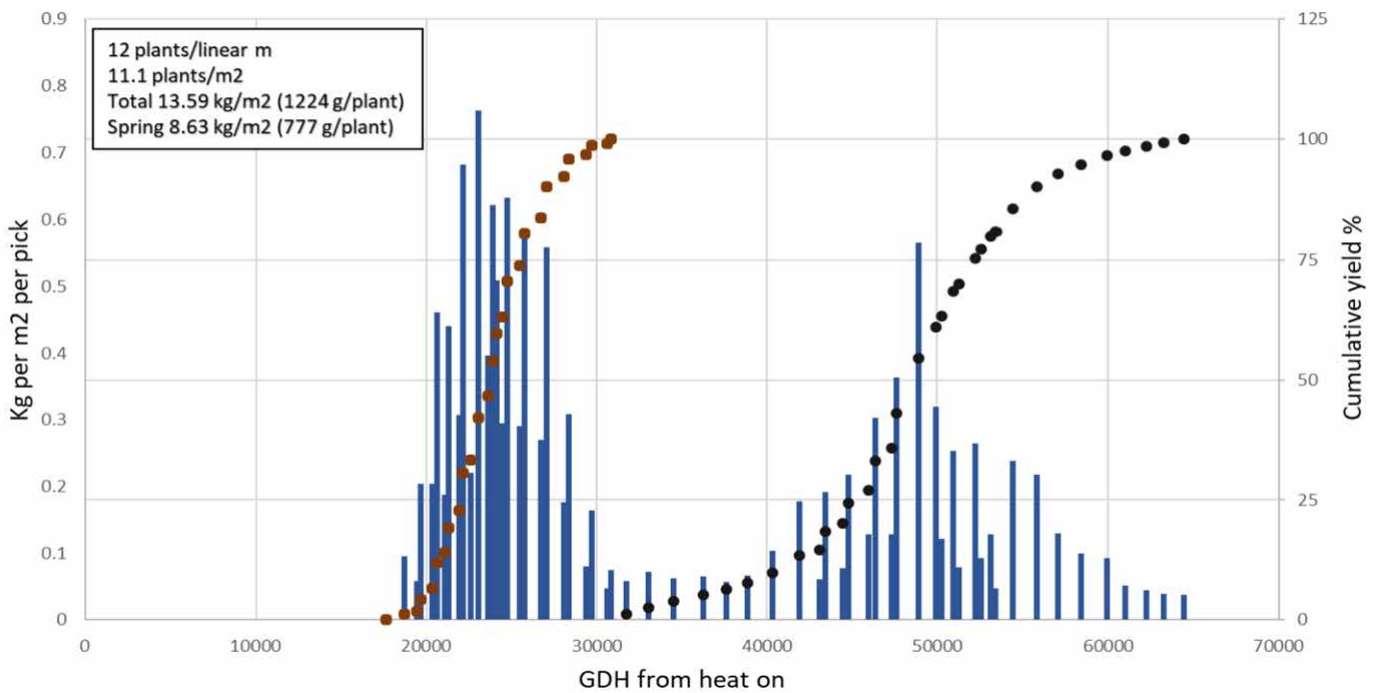


Figure 4. Malling™ Centenary overwintered spring and middle crop picking profiles 2017 (data courtesy of Nick Evans, Haygrove Sidlesham)

NUTRITION

To minimise tip and calyx burn during establishment, Malling™ Centenary starter feed recipes have a higher initial calcium requirement than market standard. It is important to plant Malling™ Centenary 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 Malling™ Centenary.

Low NH₄N at vegetative stage with none recommended during the fruiting stage. It is also very important to track Boron levels just before and during flowering.

Overall potassium requirement for Malling™ Centenary during the fruiting phase is similar to market standard, but due to its peakier crop profile, potassium 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 Malling™ Centenary compared to market standard, 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 vigor and go into premature flower induction, resulting in late autumn flower emergence (pre-flower).

Drip pH requirement for Malling™ Centenary is similar to market standard (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.

Irrigation should be completed at least 2 hrs. before sunset to allow a dry back period before dark, therefore ensuring the plants are in a good state and for preventing wet root conditions. Moisture levels should be monitored continuously if possible or at least once daily as a minimum.

If plants are used for overwintered crops, then moisture needs to be controlled very accurately during the cold period. Levels should be around 45%-50% avoiding big fluctuations and avoiding having plants very wet for too long.

	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

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 effective Botrytis fungicide 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 0-1 day harvest interval Botrytis sprays throughout picking (e.g. fenhexamid, Bacillus subtilis). Always check product authorisations 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 fungicide sprays soon afterwards. Avoid crown damage where possible;
- // De-crowning, where required, should be done earlier in the year than with market standard (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 infection risk, 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 as they are seen.
- // Remove runners promptly where mildew risk is high.
- // Apply a robust protectant spray program, based on products containing: penconazole, azoxystrobin + difenoconazole, difenoconazole + fluxapyroxad and fluopyram + trifloxystrobin.
- // Where mildew is a problem on fruiting Malling™ Centenary, include sprays of potassium bicarbonate at 6.0-7.5 g/l (+ wetter) in order to eradicate spores. Follow up with 1-3 day harvest interval protectant products (e.g. difenoconazole + fluxapyroxad, 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*, and plant losses can be very high (up to 30% crown rot). Over the 10 years since commercialization, the propagators have developed great knowledge about optimum propagation of the variety, thus greatly improving the quality of fruiting plants.

However, caution is still required due to its high susceptibility:

- // 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. More than 3% of plants displaying crown rot symptoms represents a problem during production.
- // Promptly remove any collapsing plants and keep a record of number of plants affected. An early sign of potential crown rot problems is often exhibited by a 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 available chemical control products during plant establishment, i.e. dimethomorph. Always check authorisation 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 Fertiliser B Tank (at 5 l/1,000 l) 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 market standard.

FRUIT QUALITY AND SHELF LIFE

Since its launch in 2013, Malling™ Centenary has set new standards, raising the quality benchmark of strawberries to a new level. Having a high Class 1 yield production (>95%), fruit quality is judged to be excellent, with a regular conical shape, sweet flavour, good skin and flesh firmness, and good shelf life.

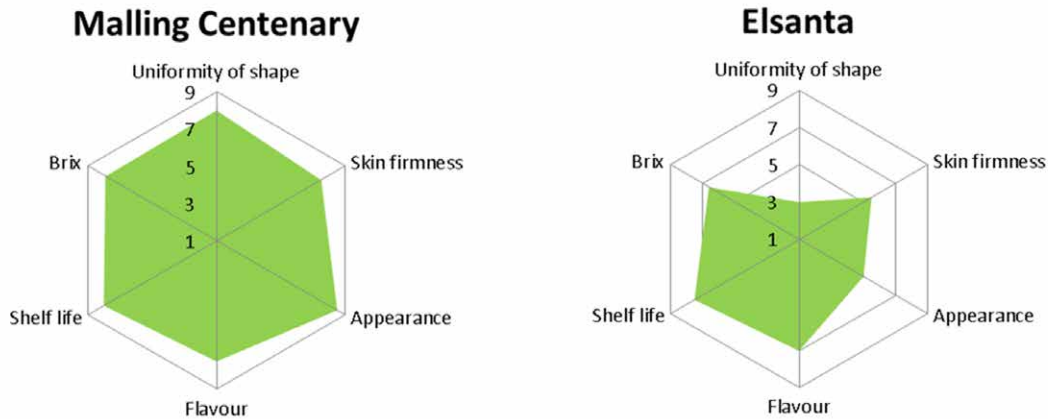


Figure 7. Mean fruit quality values from a main crop trial using tray plants grown in coir substrate under protection in the UK, where 1 = poor and 9 = excellent and actual Brix (°) Source: Troop. S.W. (2012) HDC Project SF128, Final Report

RETAILER ACCEPTANCE AND FEEDBACK

The variety stands out for fruit quality and is well-received across the major European retailers*

* For up-to-date variety listings always check with your marketing agent or retail customer.

ACKNOWLEDGEMENTS

These guidelines have been revised by: Alin Borleanu, Bayer, Scott Raffle, NIAB.