
KRAEGE
INTERNATIONAL

Stefan Kraege

Markus Staden

Dear colleagues,

among strawberry producers, the question of the right strawberry variety is an issue of passionate debate. As ever, in this year's brochure a lot of space is taken up by descriptions of our varieties.

For outdoor production, this question is certainly still justified, since the length of the strawberry season is determined by the cropping periods of the varieties planted. By using appropriate techniques, it is possible to make early varieties crop earlier and late varieties crop even later. To extend the harvest period, producers operate outdoor production systems using 60-day plants and grow everbearing varieties for an autumn crop.

In recent years, strawberry production has changed dramatically. Labour costs and labour availability in particular have led to a significant increase in intensity. It's not just in Germany that we're seeing a significant increase in the volume of production taking place under cover.

This is an area where strawberry producers have a number of ways to shape the cropping period to suit their needs. Growing under cover and in particular the addition of everbearing varieties in tabletop production systems provide producers with a wide range of options and potential combinations.

As a result, when planning your crop quantities/cropping dates, the question of the right production system is at least as important as the variety. (On pages 48 and 49 you'll find an overview of production methods, cropping periods and plant types.)

Once you've chosen your production system, you need to think about choosing a plant type to suit that system. Only then does the issue of choosing the right variety for this production system come into play.

To remain profitable with these costly new varieties, the plant type needs to be matched ever more precisely to the production system. For fruit producers, it is therefore important to discuss your expectations as specifically as possible with your plant producer. What does the plant need to achieve and what requirements does it need to meet to do so? (E.g. crown size, branch crowns, trusses, etc.) You can find some ideas and pointers on this on page 43.

We look forward to some interesting discussions, to continuing our fruitful collaboration, and wish you every success for the 2025 season.

Kraege International has been a specialist propagator of strawberry plant material since 1958. Our company produces more than 50 different strawberry varieties on about 300 hectares of rented land. Our strawberries are produced as fresh-, frigo-, potted fresh-, tray- and waiting bed plants.

We continuously work to maintain and improve the health conditions of our plants. It all starts with the production of our own mother plants. The production of the plant material takes place exclusively on new land that we rent over and over again. Soil examinations to look for nematodes and verticillium are standard procedure. The Chamber of Agriculture Nordrhein-Westfalen is monitoring the whole plant production process. Processing and storage of the plants takes then place promptly in our cold storage.

Our particular strength is the wide range of varieties we offer. Due to the good contacts we have with major plant breeders worldwide, we are able to test new varieties at an early stage. As you can see in the overview of the ripening periods on page 26/27, we have a wide range of products with all currently popular varieties included. On page 69 in this brochure, a description of the most important strawberry diseases can be found. We have also included some recommendations about precultures, nematode investigations and verticillium samples.

These descriptions are supposed to make you look twice when hearing about possible problems in cultures, yet they can't replace a cultivation consultation. We want to advise you to connect with a consulting service that suits your company! The costs that will emerge from this will come back around in form of stable and high yields that your company will then achieve.

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Production of our own Mother Plants

Healthy planting material is an important requirement for the successful propagation of their fruits. The production of our own mother plant materials is therefore a significant step to guarantee a healthy propagation of the plants. From our own experiences we know, that new plant diseases most often arise locally bevor spreading over bigger cultivation areas. This is the reason why we, here at Kraege Beerenpflanzen, work in a „closed system". We built up our own production for mother plants at an isolated and independent operating site. The risk of infection through plants from other companies can therefore be prevented.

The propagation of our elite plants starts with a thermotherapy. Meristem tissue for an „in vitro cultivation" is gathered off the plants which grow in heat cabinets. The combination of the thermotherapy and the „in vitro culture" is the procedure that offers us maximum security for a production of mother plants free from infection.

The following steps of propagation now take place solely in form of a vegetative reproduction through stolons, which happens in a saran house. The tightly woven, gauze-like saran fabric prevents insects from entering the house and infecting the plants with viruses.

Mother plants as well as seedlings are grown on table beds, in safe distance from the ground bed, so that infection by soil fungi is excluded. For extra safety, the super-elite plants (SEE) produced in the saran house are inspected for diseases on an annual basis.

The super-elite plants (SEE) are then propagated on a special site, far away from other strawberry plantations. The resulting elite mother plants (EE) are used for the production of commercial plant material and are subject to constant supervision by the Chamber of Agriculture. In 2019, the regulations for the production of certified strawberry planting material, which apply to the whole European Union, were also implemented in Germany.

Since 2019, all of the plants that are produced by Kraege are certified with the standard EPPO PM 4/11 (2) EU. For internal quality assurance, Kraege Beerenpflanzen is QS-certified.

Variety Sighting and Variety Examination

„What new varieties are there?"

is the most common question when people order strawberry plants. On demand is a healthy, early or late season variety with phenomenal fruit characteristics and a particularly high yield. In short: the „perfect" strawberry variety!
So far, this variety doesn't exist and probably won't exist anytime soon either. The breeding of new varieties is taking place with different objectives.

The health of the plants, preferably with resistances against main diseases, and a ripening period outside the main season are important criteria. Due to the good contact we have to the breeders, we are lucky to receive numerous new varieties every year for testing. The interesting varieties will be planted in our experimental garden and then tested for their special characteristics.

Usually, this refers to normal „open field cultivation". If varieties are interesting regarding this, more experiments looking at earliness or lateness will be held. Because of our own sighting of varieties, good varieties will be noticed early, examined for multiple years and in the first instance recommended for test planting.
In the intensive sighting of varieties, we see a good prerequisite for a current assortment.
The testing results are also the basis for the examination of the varieties in this catalogue.
The description is supposed to give you an overview over the current varieties and to characterize them. Results of testing facilities and impressions we have gained from our own experiences will be considered as well. It has to be said though, that a specific assessment of varieties is always heavily process- and location related. Then, it's the turn of the producer. You have to find interesting varieties that fit to your location and to your production methods.
Still, depending on the weather conditions, harvests might be different from year to year. A final evaluation of a variety is therefore only possible after 2 – 3 years.

A special evaluation of varieties is also increasingly strong production- and location based. Now, the producer himself is asked himself. At your location, with your production methods, you have to find the varieties that are interesting for you!

Aylin

Bred by **Kraege Züchtung**, **Aylin** (5/C9/8/3) is a very high-yielding variety which crops over a similar period to Sonsation. The attractive bright red fruit are uniform in shape and make a very appealing punnet. Flavour is good, with a very high yield potential.
The **Aylin** (5/C9/8/3) variety is very suited to use as a tray plant for tabletop production systems. There it convinced with extremly high yields, so it is highly recommended for producers growing for retail.

In previous variety trials (5/C9/8/3) was often called Claudia. To avoid confusion with similar-sounding varieties, the breeder decided to change the variety name to "**Aylin** ".

Jenkka

Jenkka (FE2122) is a medium early variety from Fresh Forward's breeding program which crops over a similar period to Sonata/Polka.
Jenkka is a productive variety with very good flavour. The fruits are red to dark red and uniformly conical, with a high proportion of class 1 fruits. Fruit firmness is medium rather than firm.

The breeder recommends exercising restraint with respect to nitrogen fertilisation. Attention should be paid to mildew and phytophthora.
Jenkka is particularly suitable for direct marketing and local trade channels.

Cadenza

Fresh Forward's breeding programme has come up with a new late variety called **Cadenza** (FE2134). This variety crops about 1 week before Malwina.
Cadenza has achieved promising trial results, proving to be a robust plant with very high yields and good shelf life.
The large, very firm fruit are bright red, glossy and conical in shape, and make a very attractive punnet.

The high proportion of class 1 fruit ensures good picking speeds.
Cadenza is a rather more compact plant. The breeder recommends planting at intervals of 40–45 cm within the row.
Cadenza is suitable for both retail and direct sales.

Malling Ace

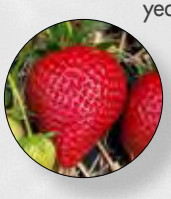
Malling Ace is a new everbearing variety from the East Malling (Bayer) breeding program. It is noted for its uniform, large, attractive, medium red fruit.

The flavour is good, with high yields.
It is very mildew prone!

Carousel of varieties

What makes a variety a good one? Or better said: When is a variety so good, that they should go on the market? The merry-go-round of varieties is turning so fast and to stay on top of things gets increasingly harder for growers, experimenters and especially for reproduction facilities. The development of a healthy reproduction takes its time and the variety should, as soon as it is available in bigger quantities, still be in demand. After all, licenses for interesting varieties are expensive and hard to get.





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While in the past, cultivation conditions were relatively comparable, nowadays there are almost as many possibilities to cultivate strawberries as there are varieties. In order to test new varieties for different production methods, fertilization programs or marketing methods there would have to be more time, capacity and money.

Most of the time, a new variety will be cultivated under standard conditions (Elsanta) on trial. If the new variety doesn't deliver enough profit within the first two years, it is removed from the product-line. Finally, there are enough varieties that can be tested.

This brings us to the next question. How many varieties do we miss, just because we are lacking the time to develop suitable cultivation methods for the new varieties?

Varieties, that are emphasized for their excellent fruit characteristics or a special taste deserve an attempt to compensate eventual weaknesses with a suitable cultivation. Looking at some varieties such as Flair (fertilization strategy), Alba (sensitive to herbicides) or Malwina (thrips, strawberry blossom), this work of compensation worked well.

For those who feel called to make new varieties successful, we always have new varieties available for testing

Tea

Tea is a medium late variety, cropping slightly later than Asia.

The fruits are large, medium red and glossy with a uniform, conical shape and a medium to good flavour. **Tea** stands out for its very good fruit firmness and high proportion of class 1 fruit.

The plant is robust and suitable for both outdoor and substrate cultivation systems. This makes **Tea** an attractive alternative, especially for supplying to retail.

NewFruits

Arianna

Arianna is a new very early variety from the breeding program of Italian company Berrylab. This variety crops about 2 days before Alba. **Arianna** can be grown both outdoors and in polytunnels. The fruits are firm, large, uniformly conical in shape, a glossy medium red, with a good flavour. **Arianna** is a high-yield, robust plant. It is particularly suitable for marketing to retail.

BerryLAB

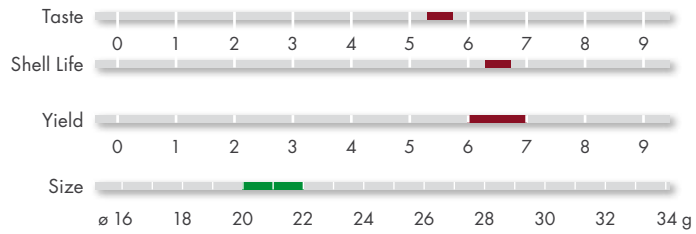
Florice

Florice (C13-115-12) is a new, everbearing strawberry variety from the Flevo-Berry breeding program. The big fruits are short and conically formed. The fruit size stays the same throughout the whole harvesting season. They have an intense red color, are glossy and quite firm.

Flevo Berry

Flair

Colour medium red, glossy
Comments expert advice for cultivation recommended to optimize growth, harvest and fruit size

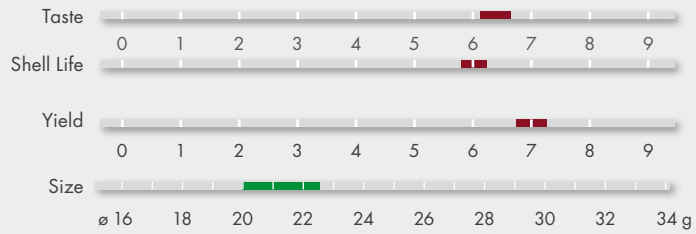


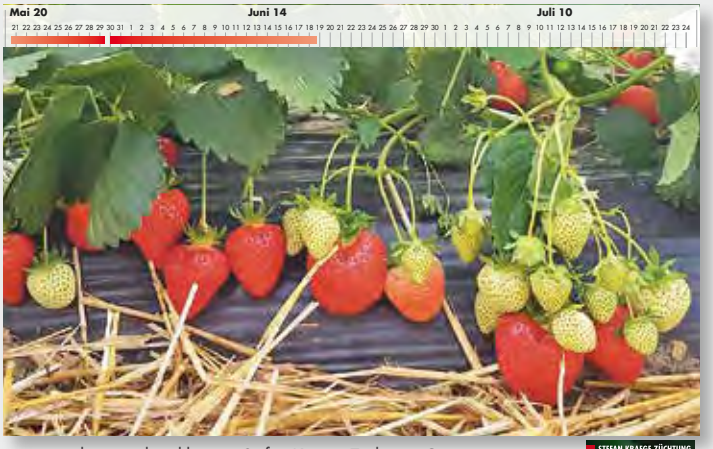
– protected variety, head licence: Flevo Berry, Netherlands

Flair is a Flevo Berry variety which ripens about 5 – 7 days before Honeoye. Flair is a rather open plant with a long inflorescence and therefore endangered regarding late frost. The harvest is very compact and you can harvest a high amount of fruits in a short time.
Flair is characterized by light red, beautifully glossy fruits. The flavor is very good.
An early water supply is very important for the size of fruits. Flair as an A+ plant is suitable for 60-day-productione.
Flair reacts sensitive to herbicide treatment shortly after planting. During the time when the plant has not correctly rooted yet, treatment should be cut short (splitting). A Ph.cactorum prophylaxis after planting is suggested.
The stock should be provided with nutrients and micronutrients at all time. Especially a lack of manganese and zinc will show itself in forms of lightened leaves. Similar symptoms you will find if the pH-value is too high or the ground temperature too low. With an early leave fertilizer you can counteract. Flair starts really fast in the spring but then is undersupplied very fast as well.
Flair is suitable for open field cultivation as well as dam culture. The best yield you will get in a tunnel. Even though Flair is a winter hard variety, you should protect the high standing rhizomes against winter frost. Flair must be taken care of really well after vegetation has started in the spring and should be supplied with water at all time. Only then there will be a good yield potential and a good flavor.

Glorielle

Colour light-red…medium red, glossy
Comments Very good flavor, interesting early season variety, special for direct marketing





– protected variety, head license: Stefan Kraege Züchtung, Germany

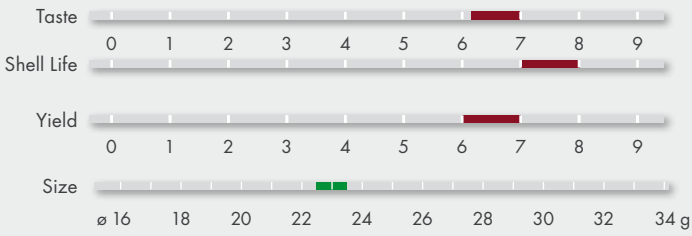
Glorielle is an early season variety from the program „Kraege Züchtung". Being new to the field of breeding strawberries, Stefan Kraege introduces the first variety from his breeding program. Glorielle is in the early ripening range and about 3 – 4 days before Clery. They win you over with their excellent taste. The fruits are evenly formed, very glossy and the painting of the skin is nice. The earnings can be compared to Clery with a higher percentage of class 1 fruits. The size of the fruits stays the same throughout the whole harvest period. Glorielle is a fast-growing variety with a high demand on Calcium and should be sufficiently nursed against mildew.
This variety blossoms underneath leaves and is therefore protected against late frost. Because of the good flavor, Glorielle is recommended for direct marketing.

– protected variety, head license: Stefan Kraege Züchtung, Germany

Séraphine

Colour light red, glossy

Comments attractive shell, very good flavor, interesting early variety for all lines of marketing



Séraphine is an interesting new variety from the breeding program of Stefan Kraege.

Stemming from the same cross-breeding as Rosaria, the ripening time, firmness and flavor of the fruits show many similarities. Both varieties have the early ripening time of Clery.

The Séraphine fruits are evenly shaped with a fruit size that remains throughout the whole harvest. The fruits are light red, glossy and show a very nice shell.

The high weight of the individual fruits and the high amount of class 1 fruits promise a very good picking performance.

We recommend to plant Séraphine as a green- or potted plant early in order to guarantee a high yield.

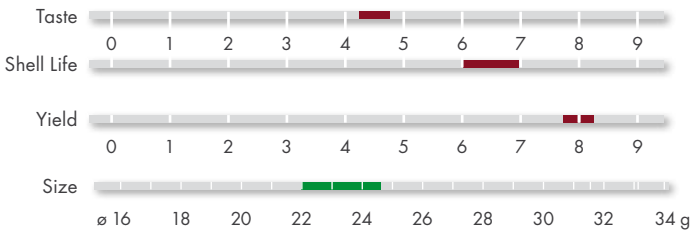
The combination of yield, flavor and health makes this variety interesting for all lines of marketing.

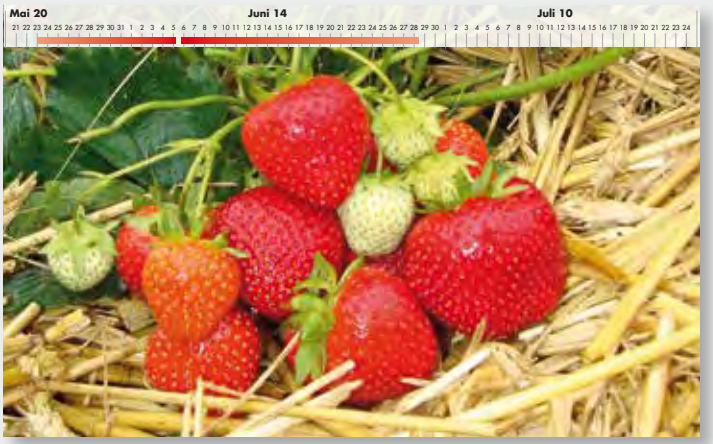
– protected variety, head license: New Fruits, Italy

Alba

Colour light-red, glossy

Comments Herbicide-sensitive (Phenmedipham Products), very firm fruits, good shelf life



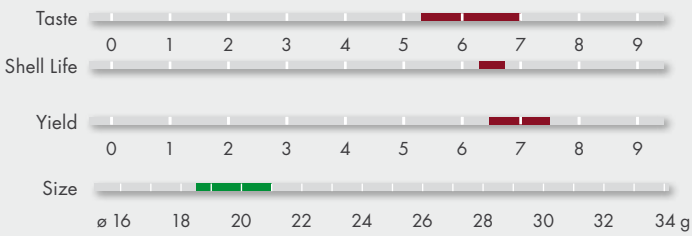


– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Allegro

Colour medium red, very glossy

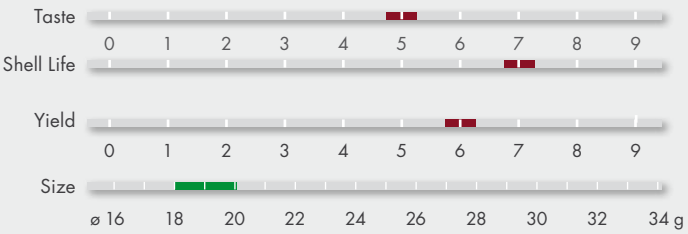
Comments attractive early variety with good taste, suitable for every way of marketing

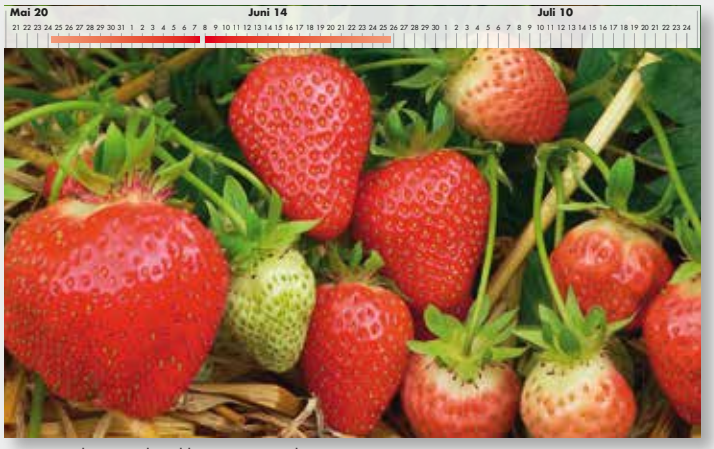


Clery

Colour medium red, very glossy

Comments attractive early variety with good taste, suitable for every way of marketing



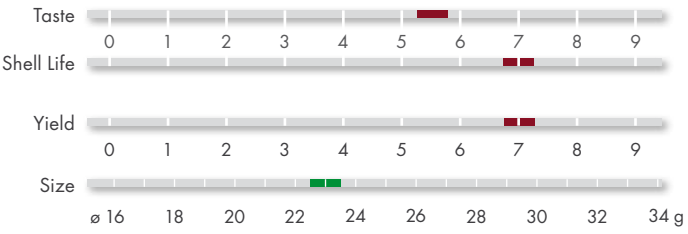


– protected variety, head license: CIV, Italy

Twist

Colour medium red, glossy

Comments interesting novelty, especially for direct marketing. Good alternative with big fruits to the Clery variety

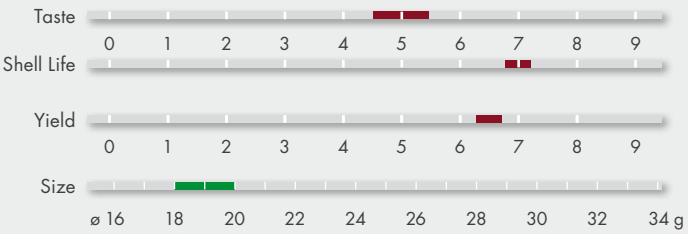


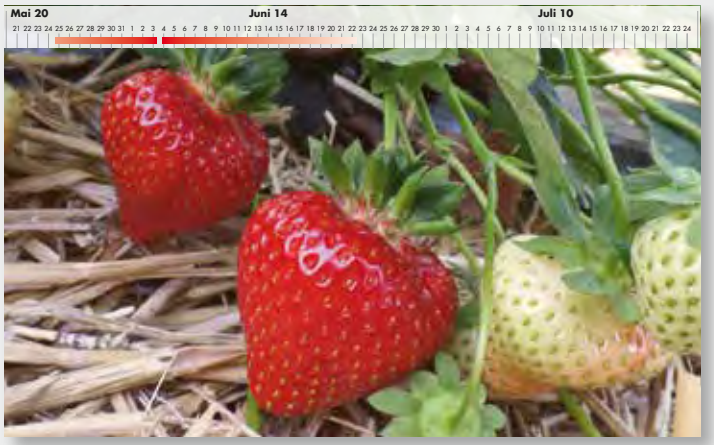
– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Dahli

Colour medium red… red, glossy

Comments Robust early season variety for direct marketing after Flair



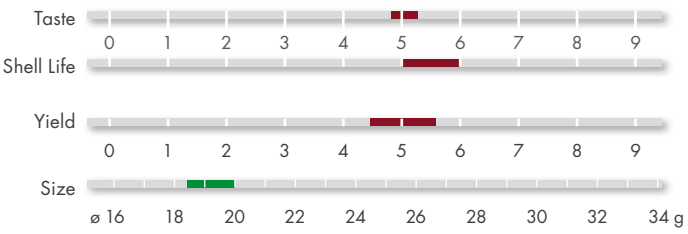


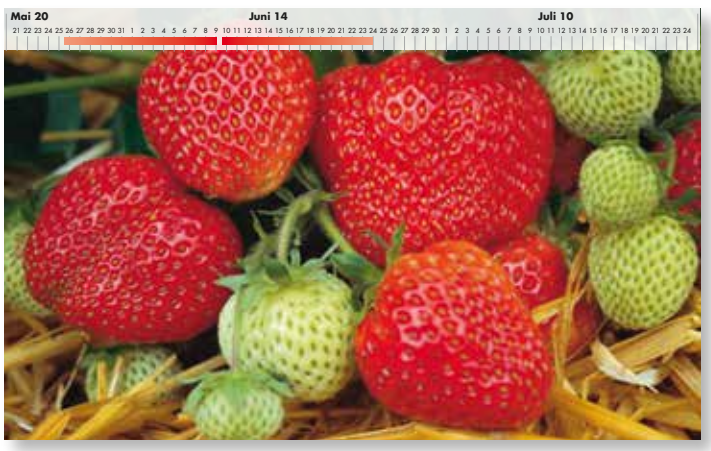
– protected variety, head licence: Flevo Berry, Netherlands

Honeoye

Colour red ... dark red, glossy

Comments susceptible to Verticillium and Phytophthora cactorum





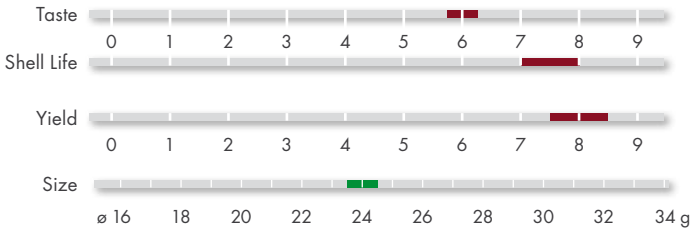
– provenance: USA

– protected variety, head license: Stefan Kraege Züchtung, Germany

Rosaria

Colour: light red, glossy

Comments: big fruits, very good harvesting performance, suitability for storage, interesting early ripening variety with a good flavor especially for direct marketing



Rosaria is an early ripening variety from the breeding program of Stefan Kraege.
Stemming from the same cross-breeding as Séraphine, both varieties show similarities in ripening time, firmness and flavor.
Also, both varieties are ripening as early as Clery. The constant big fruits are light red, glossy and good in flavor. The high weight of the individual fruits with a high amount of class 1 fruits guarantee a very good picking performance.

The first fruits of Rosaria can show a longitudinal score. This is no problem in direct marketing but could become difficult in retail sector marketing. After the first harvest, the fruits are then very even and become interesting for retail sector marketing. Rosaria can remain on the bush for a long time without turning too dark.
Rosaria is a vigorous variety with long flower heads, because of which cultivation on high dams, channels or racks is strongly advised.

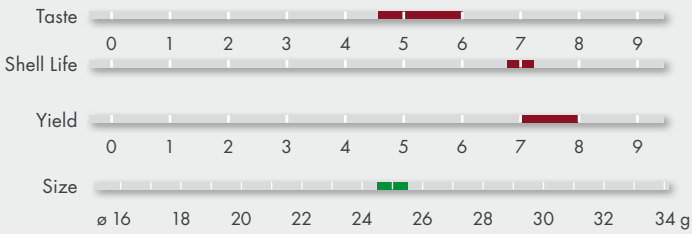
This variety is generally healthy. In individual cases, black root disease could be observed. This should be considered when planning the flower treatment. The combination of yield, flavor and health makes this variety especially interesting for direct marketing. Retail sector marketing is possible after the first harvest.

– protected variety, head license: Hansabred, Dresden, Germany

Rendezvous

Colour: light to medium red, glossy

Comments: tasty early variety with high yields



Rendezvous is a new variety from the Hansabred breeding program. It's an early season variety just like Clery. Rendezvous convinces with light, very even, attractive and glossy berries.
The shape of the fruit is a little bit round with an attractive shell-life.
The yield of Rendezvous can vary. This variety can bring high yields when cultivated appropriately. This, though, is often not very good for the taste.

Because of that, when producing for direct marketing, the distribution of leaves and blossoms need to be kept in mind.
Rendezvous produces a high percentage of class 1 fruits. The size of the big fruits stays constant throughout the whole time of harvest. Because of the high individual fruit weight, this variety is easy to pick.

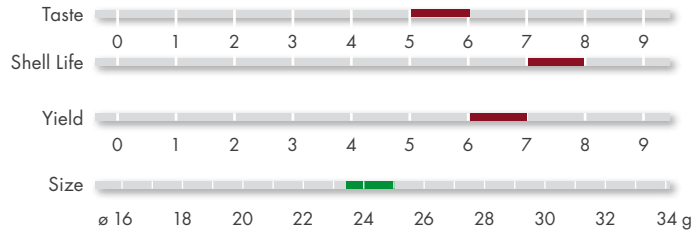
Rendezvous grows upright and is a robust variety with almost no sensitivities towards root illnesses. This variety shows some sensitivity towards mildew and should be treated accordingly.

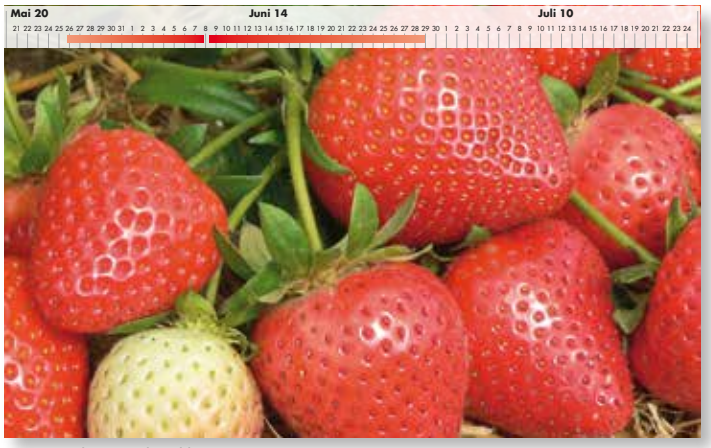
The fact that this variety is an early variety, the attractive shell-life and the good yields make Rendezvous an interesting variety for wholesale and direct marketing.

Malling Centenary

Colour medium red, very glossy

Comments very attractive fruits suitable for every marketing channel, susceptible to Xanthomonas and Phytophthora cactorum





– protected variety, head license: Meiosis, GB

Malling Centenary is an early variety from the East Malling program (GB). This variety can be pre-matured and its harvest can start 3 - 5 days after Clery. The process of harvest is very tight. Malling Centenary is very suitable for a terminated culture with strong fridges, waiting beds or tray plants. Also, there have been good results with dense planting of Frigo A plants.

Malling Centenary stands for a variety with outstanding fruit characteristics. The flavour of this variety is good to very good with a nice strawberry flavour. The fruits are medium red but darken when cooled in the coolingsystem. Malling Centenary convinces with its beautiful glow. The fruits are big and very even. We have harvested 90% of class 1 fruits! The firmness of the fruits is very good as well. Our results for the shell-life are remarkably above the ones of Elsanta.

Malling Centenary is sensitive for illnesses and has to be especially protected against Phytophtora cactorum. It is also sensitive for Xanthomonas. This variety blossoms a little bit underneath foliage and is vulnerable to blossom frost.

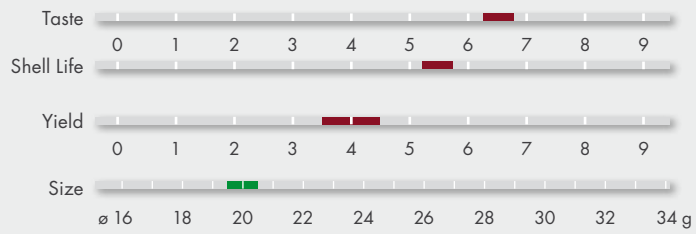
At first, some damages due to rain were reported, but now this variety can be cultivated in the open land more and more. Due to the perfect shell-life and the good flavour, Malling Centenary is applicable to all ways of marketing.

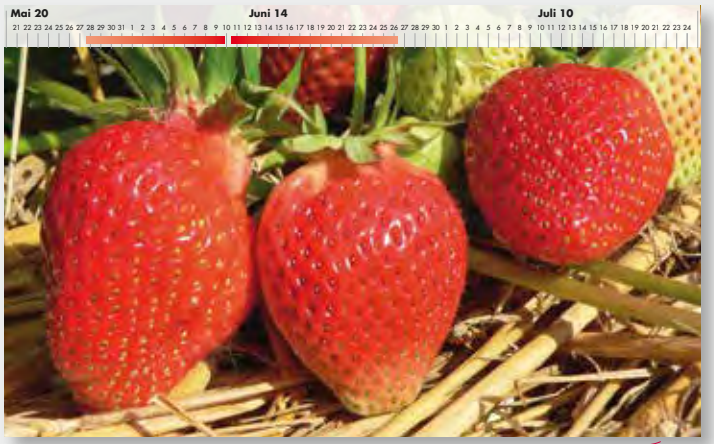
One of its strengths though is the cultivation in a tunnel. The quality of the fruits and the yield is outstanding when cultivated in a tunnel. There are pretty much only class 1 fruits with a very high individual fruit weight. The picking performance is outstanding too. For us, Malling Centenary is one of the most promising varieties on the market. It has an interesting ripening time and a good flavour. As a fruit in a shell, Malling Centenary is a class of its own anyway.

Lambada

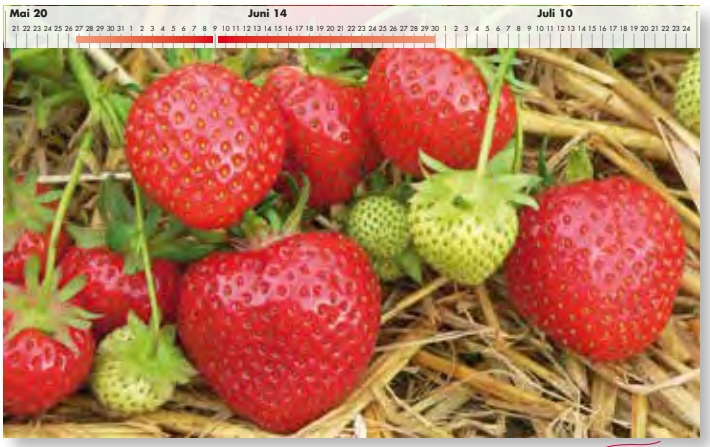
Colour bright, medium red

Comments very sensitive to mildew





– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

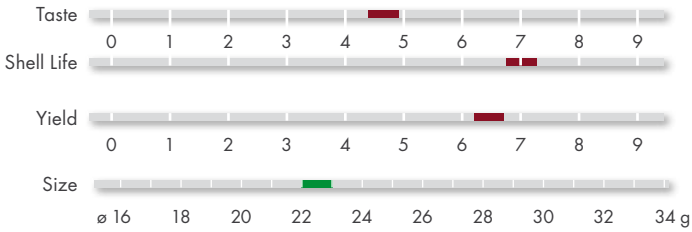


– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Rumba

Colour medium red, glossy

Comments Very good looking punnet ware, robust plant



Rumba is an early season variety from the breeding program of Fresh Forward. Rumba ripens about seven days before Sonata, but the season is considerably longer than that of Honeoye or Clery.

The variety convinces with medium red fruits with an appealing gloss. The fruits are large, uniform and firm and are easy to storage. They have a good shelf life and therefore even retain their gloss and shine after cold storage. The taste of the juicy fruits is good. Regular picking is important as the berries would otherwise get too dark.

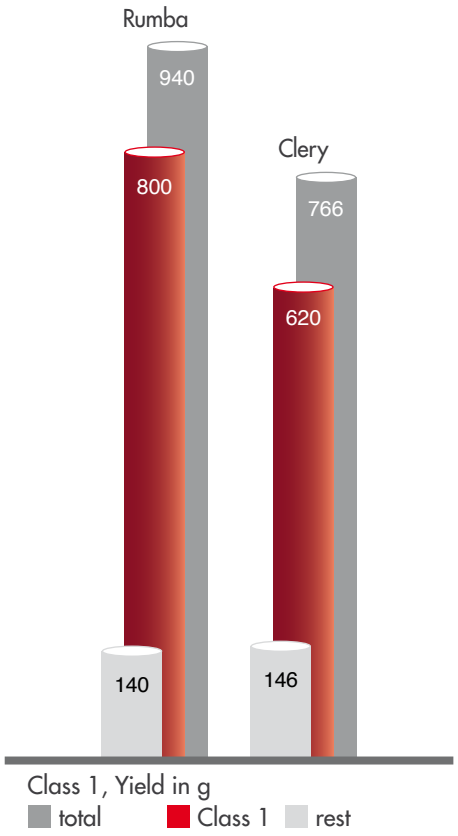
For an earlier season start, Rumba can be grown under fleece and/or foil as well as in tunnels. Yields are high thanks to the proper size and weight of the individual fruits. There are barely any misshaped fruits.

The flower trusses are not too long, so that the blossoms are fairly well protected by the foliage against late frosts and heavy rain. Also, it is important to cover the plants with foil or fleece in the spring to protect the flowers from night frosts.

Rumba is a very healthy, vigorously growing variety that has so far not shown any particular sensitivities to specific diseases. However, the breeders recommend preventive treatment against Botrytis and Rhizoctonia.

35 cm has been proven the right spacing between the plants in a row. Two types of planting can be used for Rumba: Frigo plants in the spring or fresh plants at the beginning of August. Given the large size of the fruits and the good health conditions, two-year cultivation is possible without any problems. However, the plants must then be protected against winter frosts in the second year, because the rhizomes will have grown up fairly high by that time.

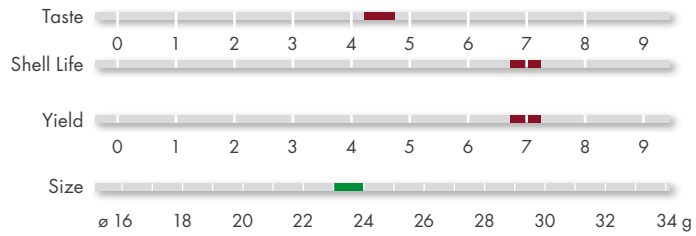
Boron-containing fertilizers should be used sparingly, as the variety tends to uptake excessive amounts of this trace element. Apart from this, Rumba is relatively easy to cultivate and no special fertilizers are necessary.



Aprica

Colour medium red, very glossy

Comments Herbicide-sensitive (Phenmedipham Products), good shelf life, very attractiv fruit for the wholesale market



– protected variety, head license: CIV, Italy

Aprica is an Italian (C.I.V.) new variety with a medium early season ripening range. The fruit ripens approximately four days after Clery. Shiny red, cone-shaped fruits with a beautiful gloss feature this variety. The fruits are continuously big with a high profit of each individual fruit. That is the reason why this variety is easy to pick. The harvest of Aprica is good with a high percentage of class 1 fruits.

With its outstanding shelf life, Aprica is recommended as a variety for the wholesale market. Aprica is a strong plant, it grows upright and is therefore resistant to leaf- and root diseases. It grows underneath leaves and as a result it is protected against frost and heavy rain.

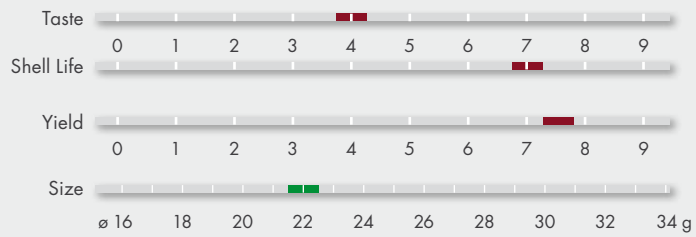
Unfortunately, the taste is not good enough for direct marketing.

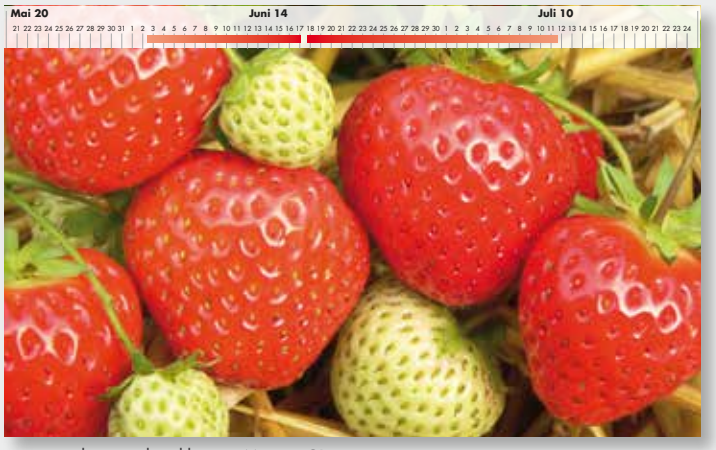
Aprica is herbicide sensitive, especially regarding Phenmedipham products

Elegance

Colour medium red, glossy

Comments very attractive fruit, great for supermarkets, susceptible for Phytophthora cactorum





– protected variety, head license: Meiosis, GB

Elegance is a medium-season variety from East Malling's breeding program (a little later than Elsanta) with a long season of harvest. Elegance convinces with big, very regular, medium sized fruits and an attractive gloss. The overall appearance of the fruits is convincing and there are almost no misshaped fruits.

Harvests are impressive with a large percentage of class 1 fruits. Its good shelf life makes Elegance an interesting variety for supermarkets, while it has to be accepted that the flavor is only average and the aroma not very pronounced. Elegance is easy to pick and suitable for 60-day production. The fruits grow upright and are well displayed on long pedicels, which permit a high picking rate.

Our experiences so far have shown, that cultivation is only possible on virgin soil with perfect production conditions.

With concerns to diseases, we have to mention the high susceptibility to mildew and Phytophthora cactorum. This variety is not suitable for replication.

Elegance is a promising variety for supermarkets. The berries look great in the punnet.

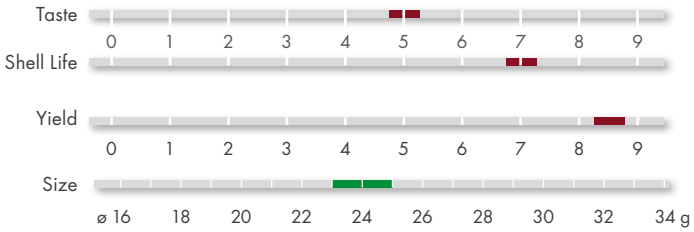
– protected variety, head license: Flevo Berry, Netherlands

Flevo Berry

Falco

Colour medium red, glossy

Comments interesting novelty, ripening time before Elsanta, suitable for wholesale market

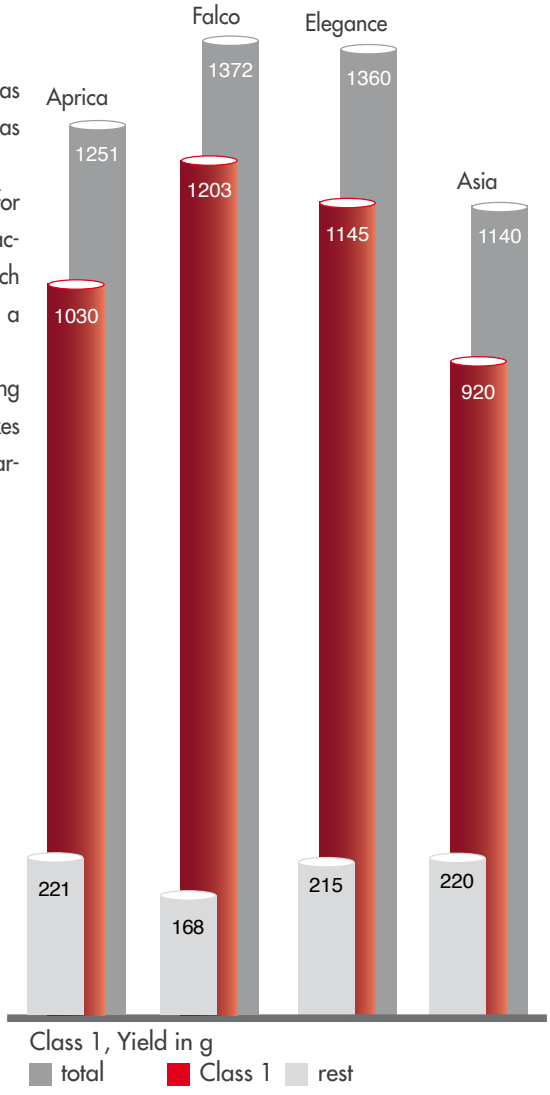


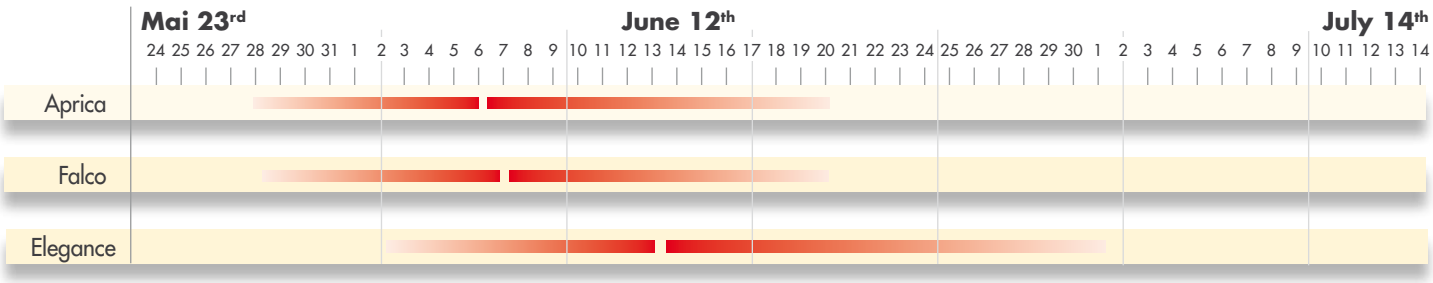
Falco is a new midseason variety from the Flevo Berry program which ripens between Aprica and Elegance. Its fruits are medium red and cone-shaped with an attractive glow. The shape of the fruits is very evenly distributed and barely shows any deformities. Sometimes, the first very big fruits can be hollow. The share of class 1 berries is very high. Falco convinces with very high yields and heavy individual fruits. The amount of one inflorescence is about 5 fruits. The taste is good with a very appealing shell.

Falco can be cultivated in the open field as well as in a tunnel. A cultivation in substrate is possible as well.

Falco is a robust variety with a low sensibility for root illnesses like for example Phythophthora cactorum. It is sensitive though for mildew, for which one should look especially when cultivated in a tunnel.

The combination of the high yield, the picking performance and the long time of harvest makes Falco a very interesting variety for wholesale marketing.





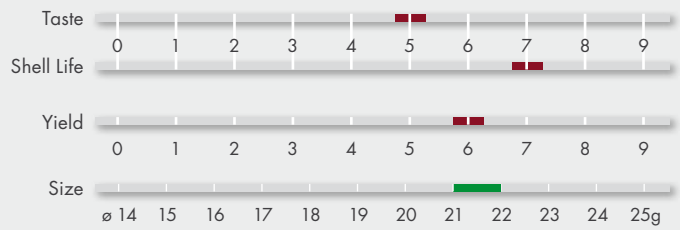
Aprica, Lola, Falco und Elegance – 4 Varieties which complement each other regarding the Ripening Range

A 5 – 6 week long harvesting period, high numbers of total harvest with an attractive shelf life makes this combination very interesting for the wholesale market.

Parlando

Colour medium red, glossy

Comments very good fruit quality, strong alternative to the variety Malling Centenary

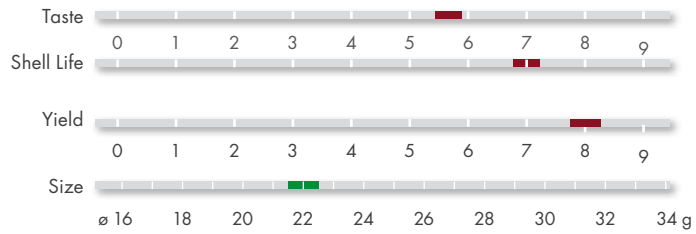


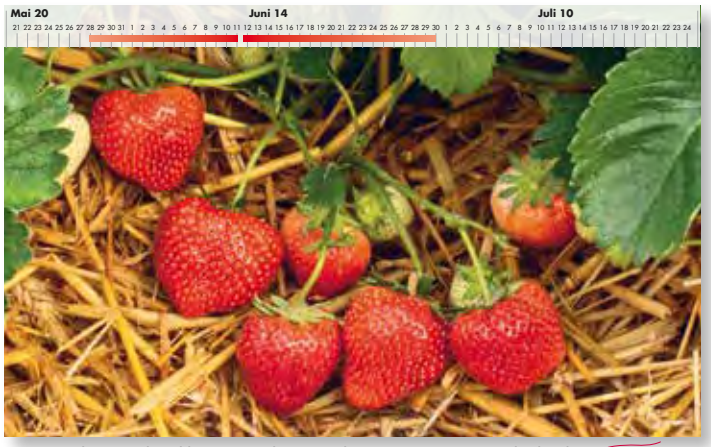
– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Verdi

Colour medium red, glossy

Comments interesting novelty with the same ripening time as Allegro, suitable for direct- and wholesale marketing





– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Verdi is a medium variety from the Fresh Forward breeding program.
Its ripening time is about 3 days after Allegro. The fruits are medium red, glossy and have an evenly conical shape. They are also big and even throughout the season they only get minimally smaller.
Verdi shows a high yield with high amounts of class 1 fruits. The fruits have an aromatic taste and a juicy texture. Verdi shows a good picking performance and the fruits have a good shelf life. The fruits should be picked every 2 – 3 days.

Verdi is a healthy, straight and upwards growing plant. It doesn't grow as much as Allegro though. Under the leaves it blossoms with about 7 – 8 blossoms per flower stalk.

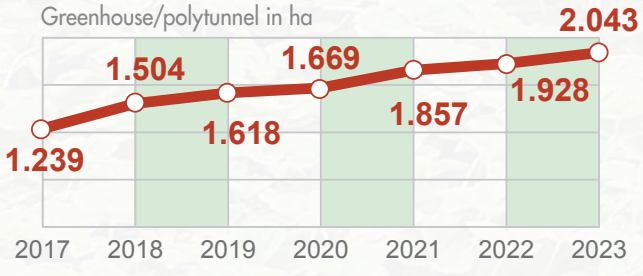
The plant is suitable as a green- and frigo plant in the open field as well as in a tunnel. Cultivating it in a substrate culture on stands is not recommended.

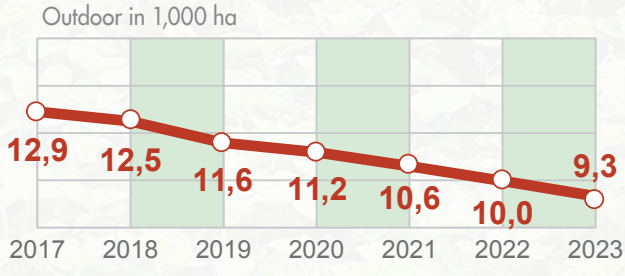
In prior testings, Verdi didn't show sensitivities against any root deseases and the sensitivity for mildew is very low.

Verdi is a recommended novelty which is suitable for different ways of marketing. The good taste makes it especially interesting for direct marketing.

30% of strawberries from under cover production

(AMI) – In Germany, the shift in strawberry production to greenhouse and tunnel systems continues apace. In 2023, the area grown under cover increased to a record 2,043 hectares. This represents a 6% increase compared to the previous year. This is a slightly higher rate of growth than in 2022, when the area grown under cover grew by just 4%. At the same time, outdoor production once again fell. At 9,300 hectares, the outdoor production area was 7% down on the previous year.



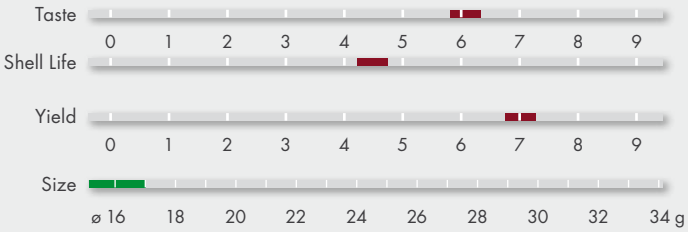


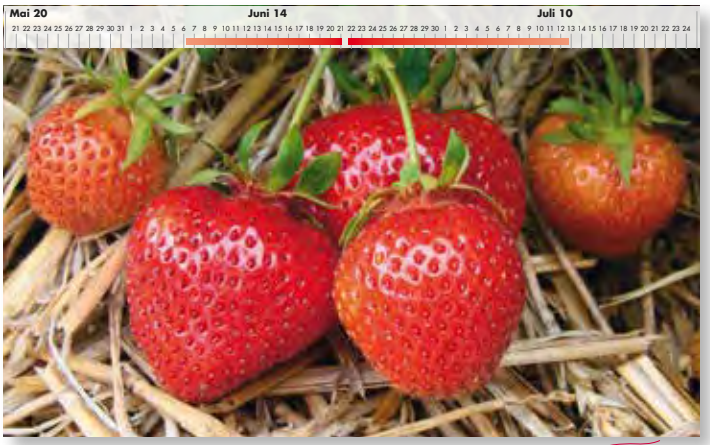
– geschützte Sorte, Sorteninhaber: Fresh Forward B.V., Wageningen, Niederlande

Korona

Colour red… dark red, glossy

Comments highly suitable for self-picking, annual cultivation recommended (size of fruit), sensitive to mildew, tolerant to Verticillium



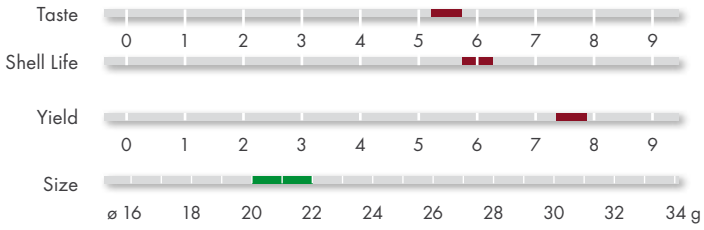


– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Sonata

Colour medium red, glossy

Comments no misshaped fruits, no green tips, suitable for direct marketing and fresh food market, sensitive to Phytophthora cactorum

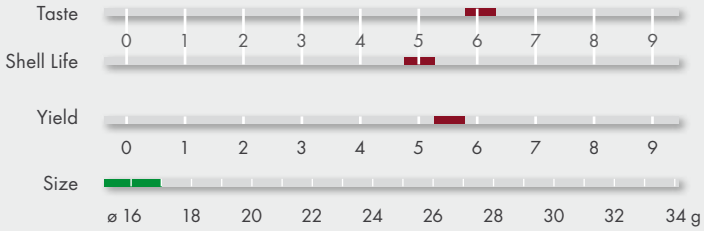


– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

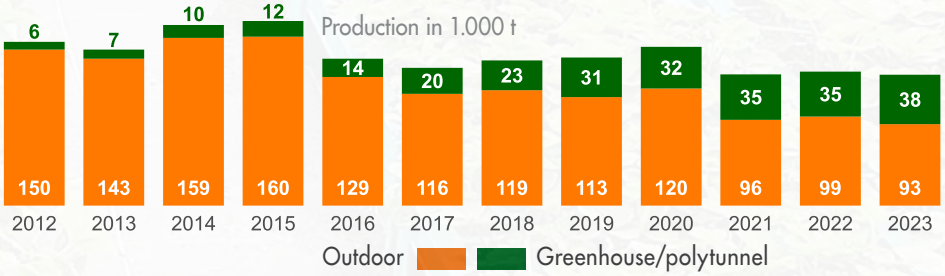
Polka

Colour dark red…red, glossy

Comments annual cultivation recommended (size of fruits), tolerant to Verticillium, slightly susceptible to mildew



The increase in area under cultivation in greenhouses and polytunnels resulted in a nearly 9% increase in yield from under cover production to 38,000 tonnes. With better weather, this increase would likely have been even larger. One thing that polytunnels can't make up for is low light levels and temperatures. Despite this, the proportion of the total crop grown under cover continues to increase.

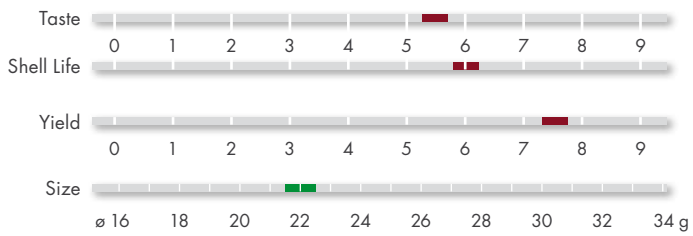


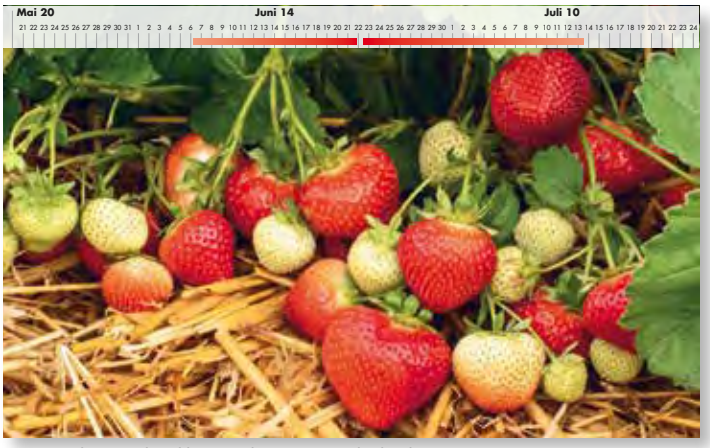
Nearly 30% of the German strawberry crop now comes from greenhouses and polytunnels.

An earlier start to the cropping period is just one advantage of growing under cover. Others include stable yields and reliable quality. This enables pickers to achieve higher picking speeds, increases picker satisfaction and improves picker retention.

Sonsation

Colour medium red, appealingly glossy
Comments interesting new variety for direct marketing



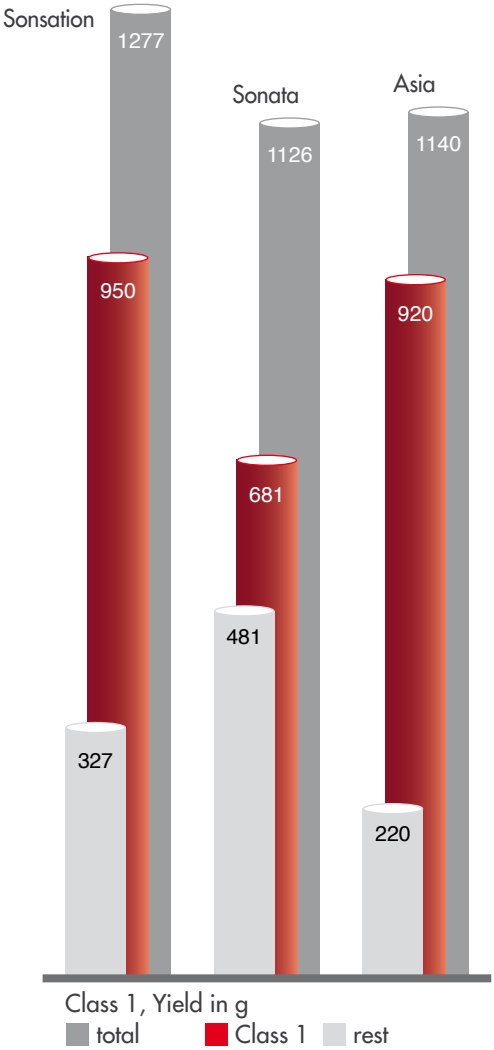


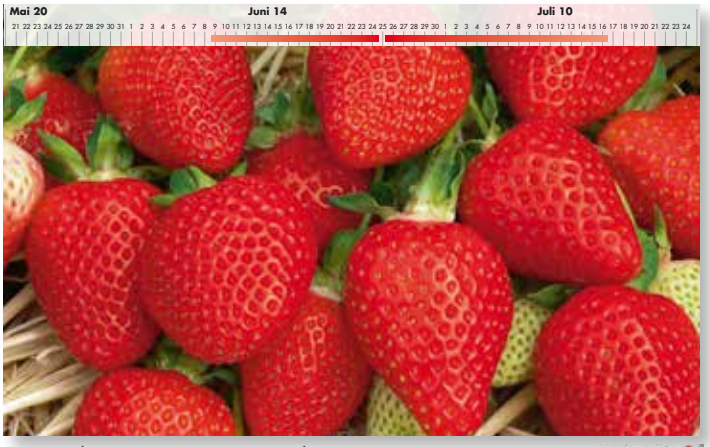
– protected variety, head license: Flevo Berry, Netherlands

Flevo Berry

Sonsation is a new variety by Flevo Berry with a medium ripening period. The fruits of Sonsation are evenly formed and easy to pick. The yield of this variety is above the ones of Elsanta and Sonata. The color of this fruit is an appealing medium red with an attractive gloss. This variety convinces with a good firmness, yet the skin of the fruit is a little bit sensitive. Due to the very good taste of Sonsation it is interesting and recommended for direct marketing.

Especially regarding the very important main season ripening period, this variety is a true gain or alternative for the current assortment.
Sonsation blossoms at the same height as the leaves and because of that the fruits are easy to pick, while at the same time, they are protected from frost. The percentage of class 1 fruits is high. This variety grows fast and is not very sensitive for diseases.
Sonsation has a high need for trace elements. When fertilizing, this should be kept in mind and considered. This variety is also suitable for reproduction sites. Sonsation is an interesting new variety especially for direct marketing. If the firmness of the fruit is sufficient for the wholesale market time and experience will show.



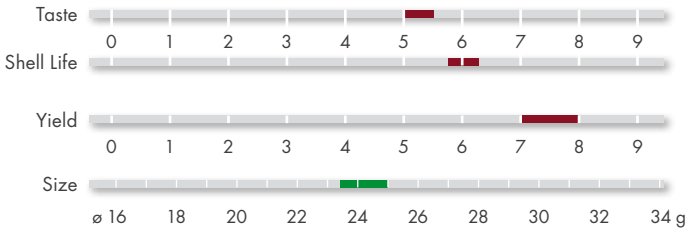


– protected variety, owner: New Fruits, Italy

Asia

Colour medium red, glossy

Comments very big fruits, look nice in punnet or basket, first fruits very big



Asia, a breed by New Fruits in Italy, ripens about 2 – 3 days after Elsanta. The uniformly shaped, attractively glossy fruits feature an excellent firmness. If the arrival is early due to the application of foil, most of the time the first fruits will be crippled.

The fruit colour of Asia is a bright medium red. Yields match those of Elsanta, with a larger percentage of class 1 fruits. Asia blossoms slightly under the foliage and the large fruits enable a high picking rate.

In the basket as well as in the punnet, the fruits are very nice to look at. This makes Asia an interesting variety for pick-your-own and direct marketing. Depending on weather conditions, wholesale marketing can also be worth a try.

The plants are vigorously growing and little susceptible to Verticillium. This variety is a little bit sensitive to Phenmedipham products!

Important

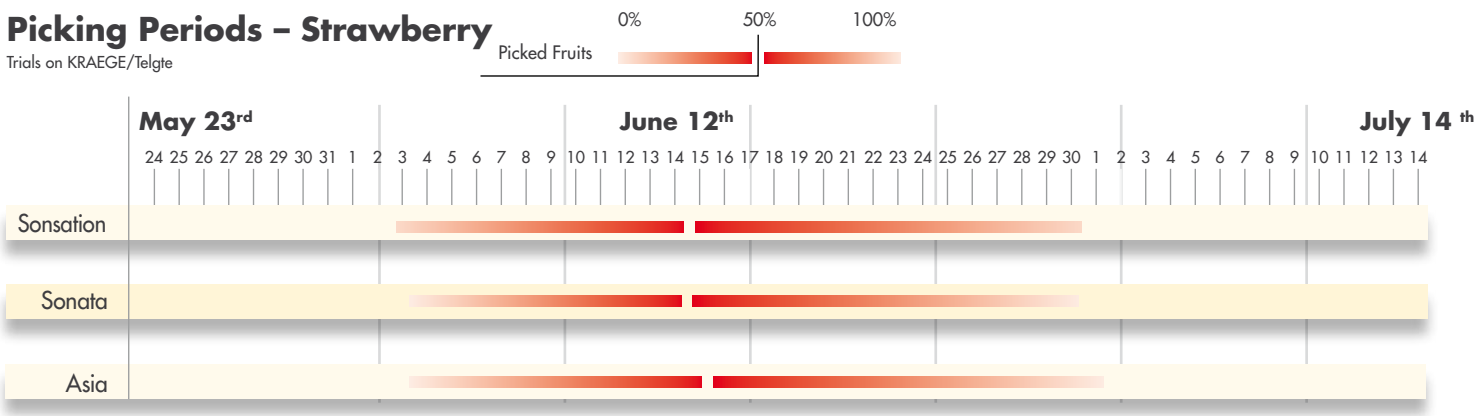
- Ripening period a few days after Elsanta
- first fruits are very big
- after rain tendency to rupture

Advantages of Asia

- good to very good taste
- big attractive fruits
- robust fruit
- good presentation in basket and punnet
- high yield
- high picking rate

Picking Periods – Strawberry

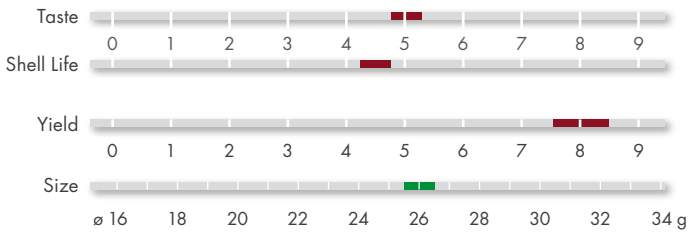
Trials on KRAEGE/Telgte

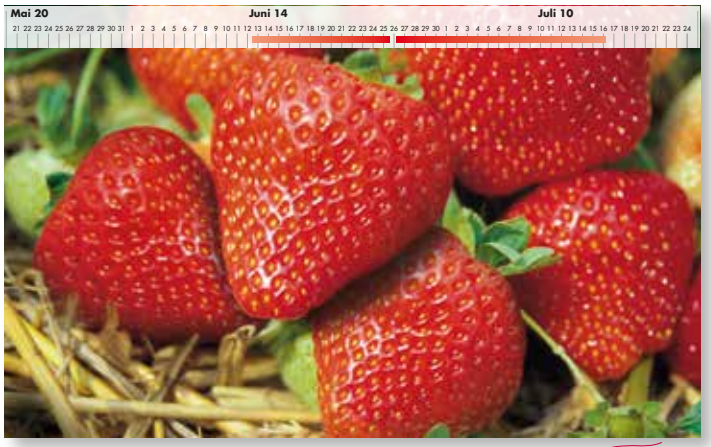


Salsa

Colour medium red … red, glossy

Comments very high yield, fruit has white frill, for direct marketing or „pick-your-own"



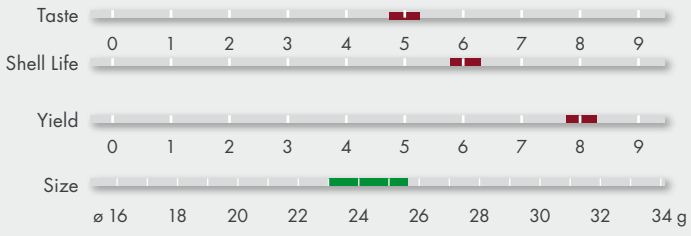


– protected variety, head license: Fresh Forward B.V., Wageningen, Netherlands

Faith

Colour medium red, glossy

Comments attractive fruit, suitable for supermarkets, direct selling and pick your own

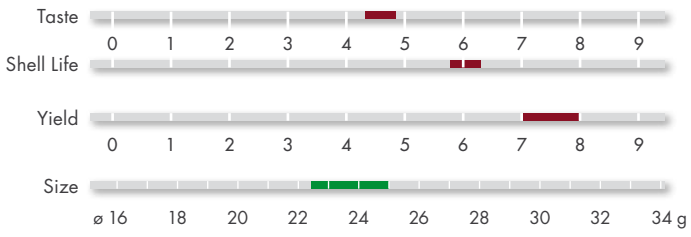


– protected variety, head license: Flevo Berry, Netherlands

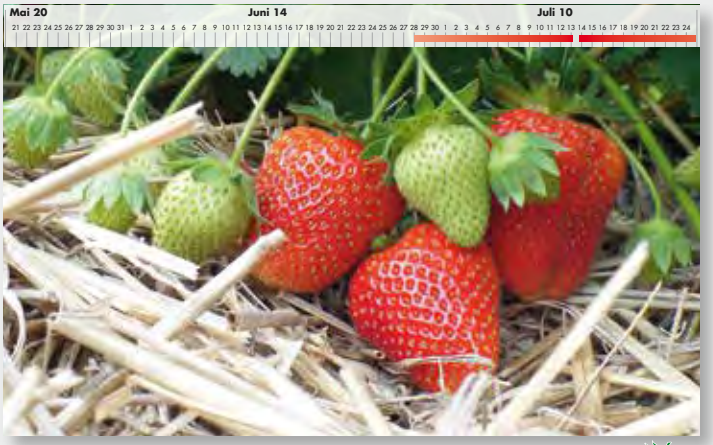
Florence

Colour red … dark-red

Comments good disease resistance, susceptible to sunburning



– protected variety, head license: Meiosis, GB

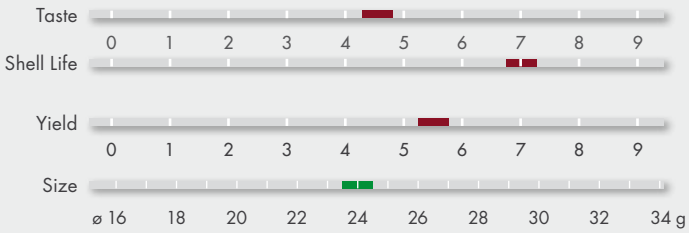


– protected variety, head license: Flevo Berry, Netherlands

Magnus

Colour red … dark-red

Comments good disease resistance, susceptible to sunburning



Magnus is a late season variety from the breeding program of Flevo Berry. The variety convinces in the ripening period about 10 days after Florence/ Faith with attractive fruits and a good taste. The yield is high. The fruits of Magnus are big and evenly, conically shaped. The colour is a light to medium red with a nice gloss. Magnus looks nice in the punnet with a high percentage of class 1 fruits.

It blossoms for a short period underneath the foliage and is then easy to pick.

This variety is robust and vigorously growing. Therefore, the distance between plants should be large.

Magnus is resistant to leaf diseases. Just as it is the case for all late season varieties, thrips and strawberry blossom should be kept in mind!

Because of its yield, the firmness of the fruits and the colour, Magnus is especially interesting for the wholesale market and a nice addition to the late season product range.

Careful with too much nitrogen! – bad inflorescence!

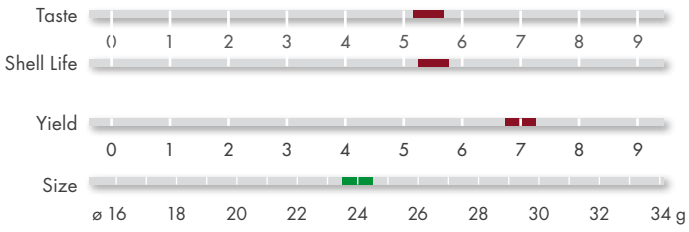
The variety Magnus has the problem that under certain conditions it will stay vegetative and then it won't grow enough blossoms. To avoid that, the supply of nitrogen needs to stay at a minimum. Well supplied soil doesn't qualify for the cultivation of Magnus! Pre-cultures which reveal nitrogen are also not suitable. Towards the end of summer this variety can be "tortured" a little bit, no or only a little bit of fertilizer, no mildew treatment etc. The cultivation risks for frigo plants are even higher as for green plants. Cultivating this variety should take place after consulting the breeder (Flevo Berry).

– protected variety, head license: Peter Stoppel, Germany

Marieka

Colour red … dark-red, glossy

Comments very good flavor, sensitive fruit skin, interesting alternative in direct marketing to the variety Faith



Marieka is another late variety from the Peter Stoppel breeding program. With a relatively short cropping period, this variety crops between Faith and Malwina.

Marieka produces attractively glossy, good-sized, red to dark red (slightly lighter than Malwina) fruits. The yield is medium. The skin of the fruit is fairly sensitive, but they otherwise keep well.

Marieka has a very good flavour.

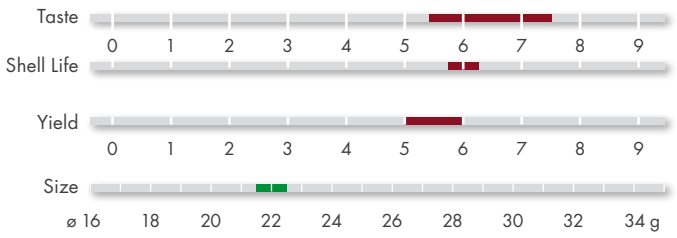
Marieka is a very vigorous plant, and the planting distance should be selected accordingly. Fertiliser application should be correspondingly conservative. This variety is extremely robust and has low susceptibility to root diseases. This means it can also be suitable for areas previously planted with strawberries. Marieka is also suitable as a 60-day plant for a first harvest in the year of planting.

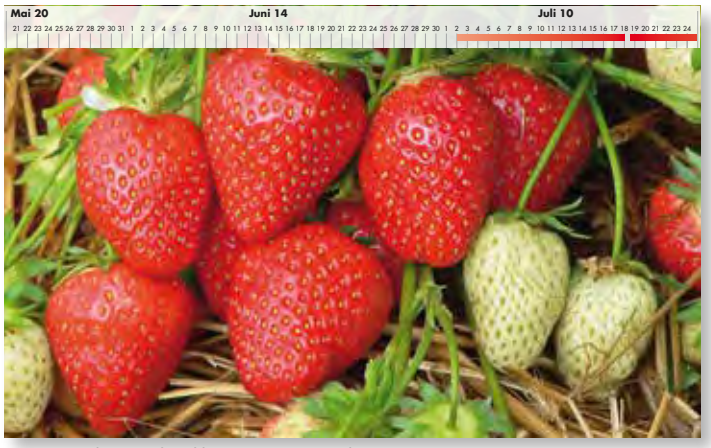
We particularly recommend Marieka for direct sales and pick your own as a useful way of extending the cropping period prior to Malwina.

Malwina

Colour red, glossy

Comments very late variety, self-fertile, the late season variety for direct marketing

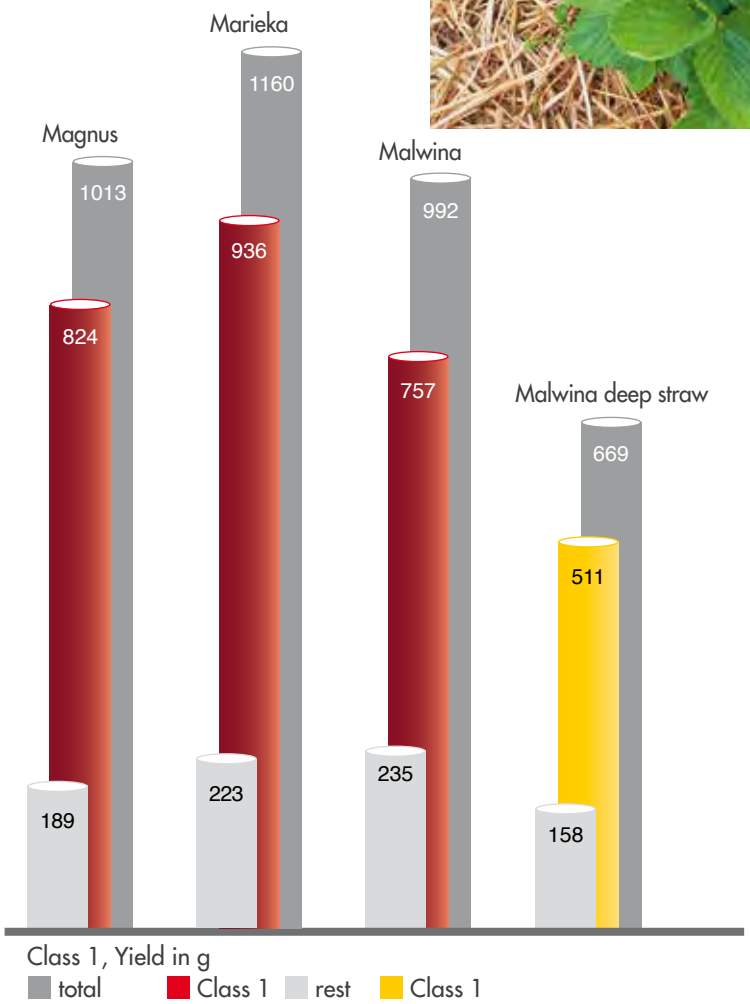




– protected variety, head license: Peter Stoppel, Germany

Advantages of Malwina:

- very late ripening period
- self fertilizing
- very good taste
- appealing fruit
- tolerant for Verticillium



Important:

- removing the flower trusses is necessary if the plant was planted late
- if the planting date was too late no blossoms will be induced
- no gap of the harvest due to cultivation of other late season varieties
- Improvement of firmness of the fruit if you pick them every other day (important for wholesale marketing)
- special crop protection necessary against thrips and anthonomus rubi [strawberry blossom]!)
- sensitive to Phytophthora cactorum. Crop protection with phosphorus acid recommended

Malwina is the latest ripening among the currently available strawberry varieties worth growing. It is setting new standards for late season varieties in direct marketing. Even under standard cultivation conditions, the medium time of harvest is 22 days after Elsanta (12 days after Florence). When straw covering is applied it ripens about 30 days after Elsanta.

Malwina is a crossbred of 'Sophie' x „Clone" (Schimmelpfeng, Weihenstefan). The crossbreeding was done in 1998 by Peter Stoppel, Kressbronn.

The plant is very robust and vigorous with dark green, medium sized, glossy leaves. Malwina blossoms underneath the leaves and is self-fertile. It is tolerant to Verticillium and is very suitable for reproduction sites.

The fruits are large, firm and feature a glossy medium red. When picked light red (wholesale marketing), their flavor is good, while when picked fully ripe, the flavor is excellent.

Malwina is a pleasure to the eye, in the basket as well as in the punnet. Its aroma reminds us of „strawberries from grandma's garden", as a customer once said it. The harvest of Malwina is about 15% lower than the ones of Elsanta (and about 20% lower when straw covering is applied). The percentage of large fruits is 85% (about 77% with straw covering). The proportion of marketable class 1 fruits is therefore higher than of Elsanta fruits.

Yet, the picking rate is 15% lower due to the short pedicels and the amount of foliage. Only when straw covering is applied, nitrogen fertilization should be taken into consideration. Wild populations should, depending on the climate and soil, only be fertilized very carefully (too much fertilization leads to a decline of the picking rate).

About 3% of the fruits feature so called „leaved inflorescences". This genetic defect causes small leaves emerging from the fruits in about one fruit per plant.

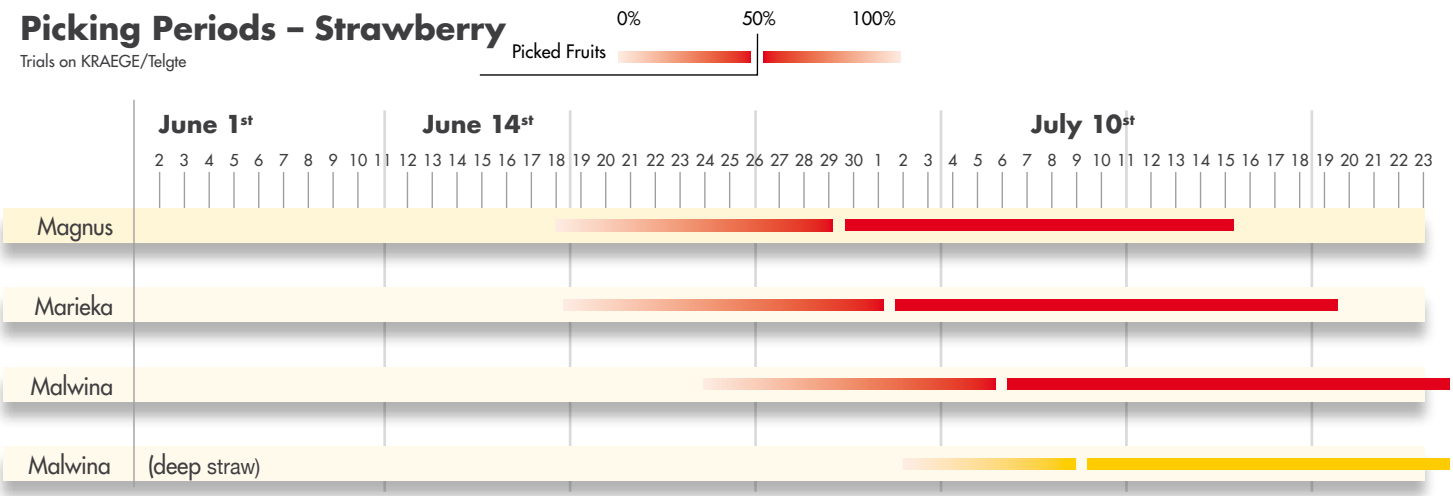
Malwina is very hardy and resistant to diseases. For example, it is tolerant to Verticillium, very little susceptible to fruit rot and usually not affected by mildew. Malwina withstands intense rain and is little susceptible to sunburn.

If the planting date was too late no blossoms will be induced.

Very important is a special spraying program against thrips and anthonomus rubi (strawberry blossom)!

Picking Periods – Strawberry

Trials on KRAEGE/Telgte



Trial on
KRAEGE/Telgte

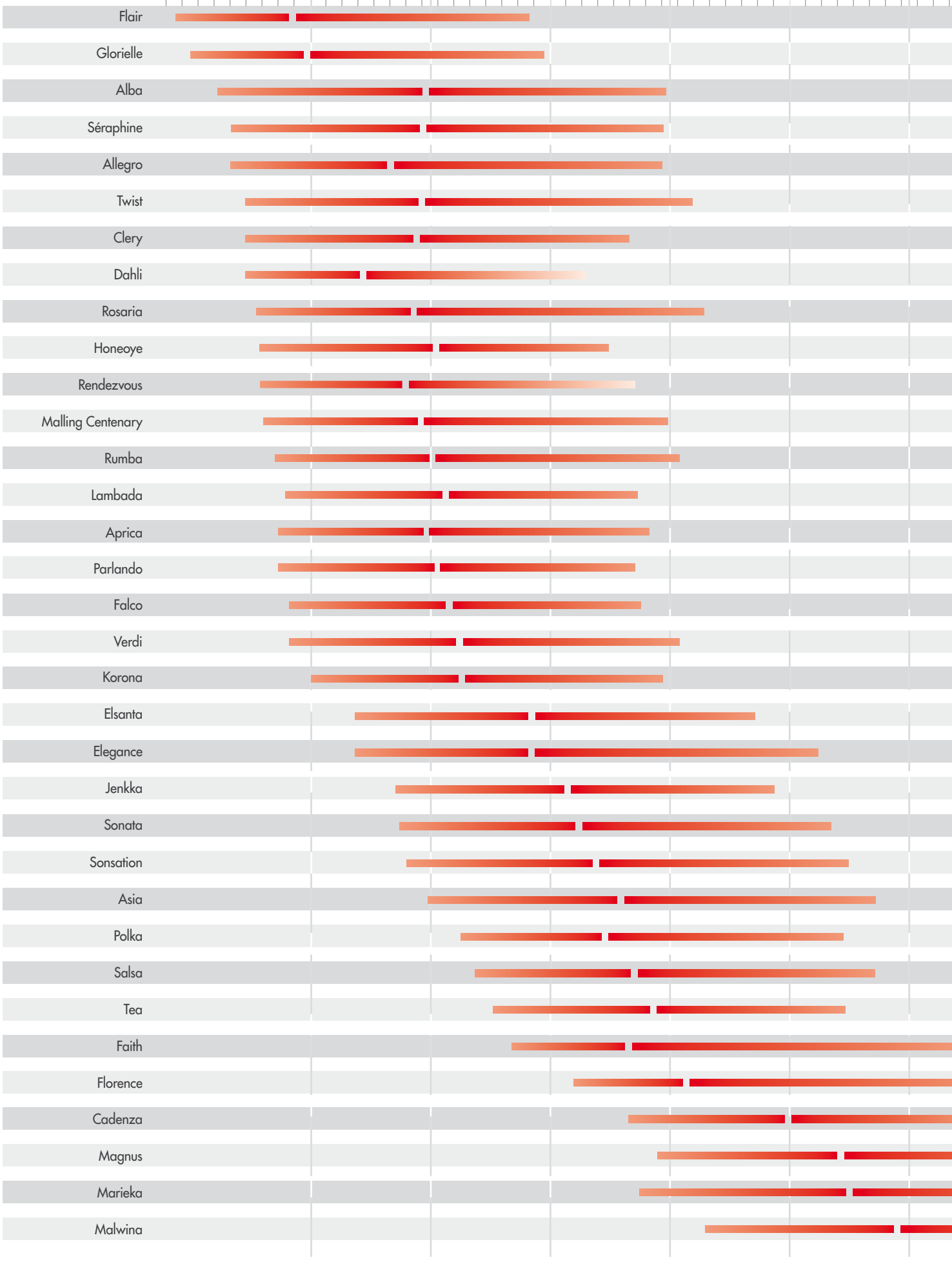
KRAEGE
BEERENPFLANZEN

Picking Periods Strawberry

0% 50% 100%
Picked Fruits

May 20 **June 14**

21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9



Strawberry

July 14

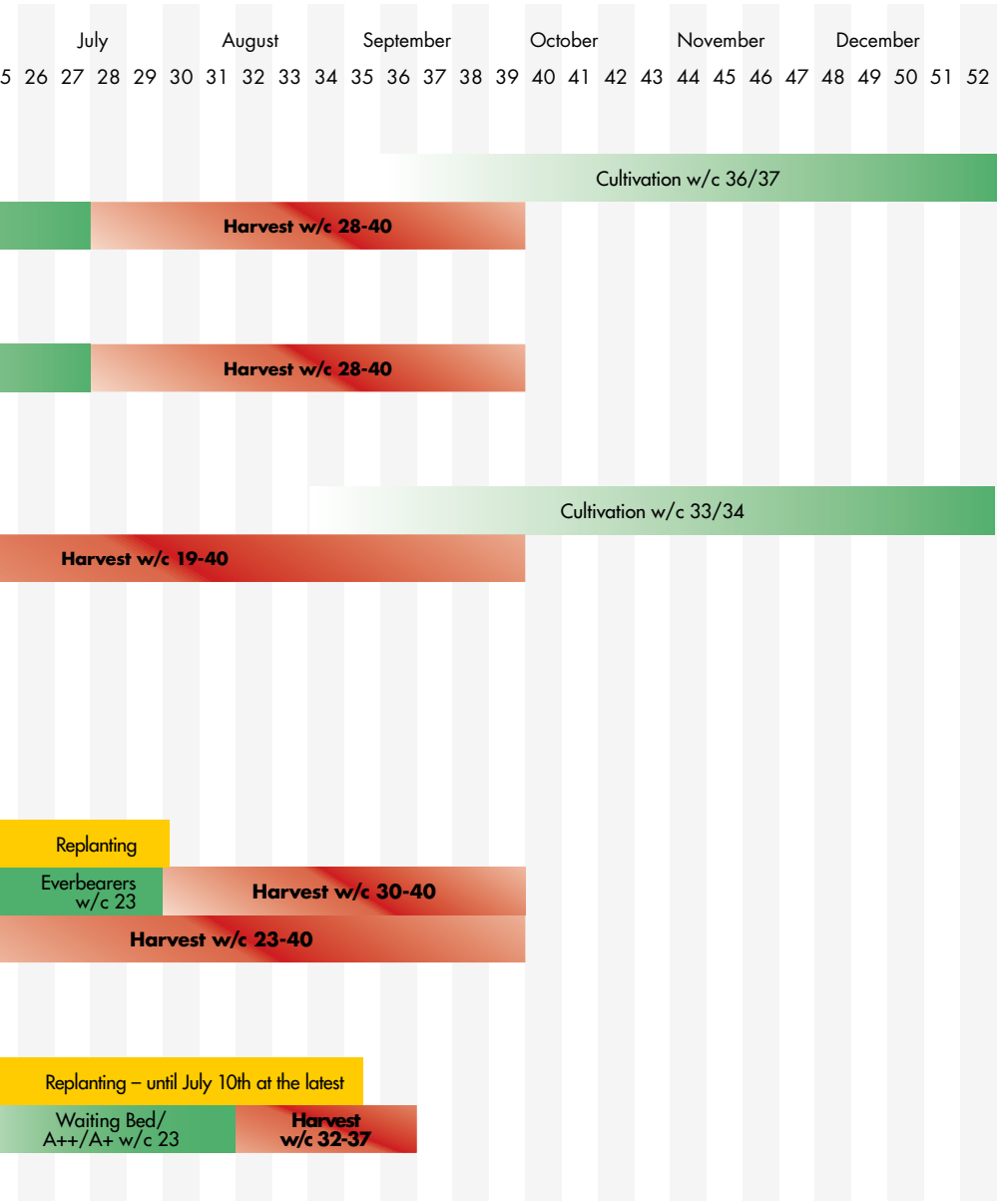
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Taste 0 – 9	Shell Life 0 – 9	Yield 0 – 9	Size Ø g/Fruit	Comments
5,5	6,2	6 – 7	20 – 22	Interesting early variety with a good taste
6,1	6	7	20 – 22	very good taste, interesting early variety
4,6	6,5	8	22 – 24,8	Herbicide-sensitive
6 – 7	7,5 – 8	6 – 7	23	very good flavor, high picking performance
6	6,5	7	19	suitable for all marketing channels
5,5	7	7	23	interesting novelty for direct marketing
5	7	6	18 – 20	standard variety in tunnels
4,5 – 5,5	7	6,5	18 – 20	strong early variety for Direct sale
6	7,5 – 8	7,5 – 8,5	24	good flavor, suitable for damm cultures and racks
5,2	5 – 6	5	18 – 20	early variety for northern growing areas
4,5 – 6	7	7 – 8	25	tastefull early variety with high yield
5,2	7,5	6 – 7	23 – 25,5	the fruit qualities are simply outstanding
4,9	7	6,5	22 – 23	safe yield, safe taste
6,5	5,5	4	20	very good taste
4,5	7	7	23 – 24	attractive variety for wholesale market
5	7	6	21 – 22	strong alternative to the variety M. Centenary
5	7	7 – 8	23 – 25	high yield potential, good shelf life
5,5	6,5	7	22	firm texture, soft skin
6,25	4,5	7	15 – 17	Pick-your-own variety for the annual culture
4 – 5	6	6	16 – 19	Greenhouse, 60-day culture
4	7	7,5	22	very sensitive for Phytophthora
6	5,5	6,5	20 – 22	very good taste, not recommended for replanting
5,5	6	7,5	21,5	direct marketing, vulnerable to Ph. cactorum
5,5	6	7,5	22,5	standard in direct marketing
5,3	6	7,5	23,5 – 25	big fruits, good taste
6,25	5	5,5	15 – 17,5	one year cultivation recommended
5,2	4,5	8	26	various taste depending on the weathe
4,5	6,0	6 – 7	24 – 25	suitable for wholesale market, „late Asiatype“
5	6	8	23 – 25,5	bright fruits, good taste
4,7	6	7,5	22 – 25	dark fruits, good yield
5	7	7	23 – 25	suitable for all marketing channels
4,7	7	5,5	24	late variety for wholesale market
5,2	5,5	7	24	tasty late variety, alternative to variety Faith
6 – 7	6	5,5	22	„The late variety“ with excellent taste

Everbearing varieties

Cultivation of everbearing strawberry varieties has increased during the past years. While in the past these varieties have not been of good taste, new everbearers are becoming much stronger regarding this aspect. Another reason is probably the expansion of the substrate culture growing in foil tunnels and green houses. The experiences with these cultures encourage the growers to try this form of Strawberry cultivation too.

When talking about everbearers, we are talking about varieties that always carry fruits. Other than the varieties that only carry fruits once during the summer period, these plants can induce blossoms throughout the whole year. Merely light and temperature conditions have to be correct. These everbearers therefore allow for a yearlong strawberry production. The harvest of these strawberry varieties takes place in multiple consecutive „harvesting waves". Depending on the date of planting and management of the culture, the harvests of each individual plant can be increased. A precise planning of harvest yields and time periods is important.



In a protected substrate cultivation there are interesting possibilities of combination with strong Frigo plants (A+), waiting bed or tray plants. This offers the opportunity to use the existing foil tunnels or greenhouses multiple times a year (see illustration).

After a 60-day culture in the spring with strong Frigo plants, the plants that have been harvested get removed and replaced in form of everbearing plants. Ideally, in the spring those had been put in planters already in form of Frigo plants to precultivate them. After exchanging the two plants, harvest can be continued without a long break.
After the harvest in the first year there might be another opportunity, depending on the variety and inventory. Plants could hibernate on the soil in a tunnel and then harvested again in the next year.
The harvest in the second year can take place as late as October.
Afterwards, the tunnel stays empty over the winter and one can start over with a 60-day culture with strong Frigo plants. Another way would be to harvest only until July and then start replanting.

Which way of cultivation is the best for you depends on your marketing opportunities.

Mara des Bois	Direct Marketing Taste Yield	Commercial Marketing
Favori	Direct Marketing Taste Yield	Commercial Marketing
Florice	Direct Marketing Taste Yield	Commercial Marketing
Malling Ace	Direct Marketing Taste Yield	Commercial Marketing
Murano	Direct Marketing Taste Yield	Commercial Marketing
Hademar	Direct Marketing Taste Yield	Commercial Marketing
Malga	Direct Marketing Taste Yield	Commercial Marketing

Mara des Bois

Favori

Florice

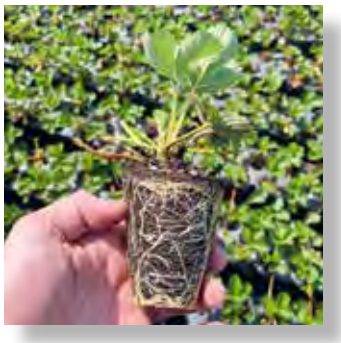
Malling Ace

Taste 0 – 9	Durability 0 – 9	Harvest 0 – 9	Size g/Fruit	Description
7	4	4,5	15 – 16	French cultivation with the note of wild berries. Yield, size of the fruit and Shelf life of Mara des Bois is in the medium field, yet the taste is excellent. This variety is suitable for special markets such as catering, pastry shops or as a special feature in direct marketing.
6	5,2	5,5	16 – 18	Regarding the taste this is a very good variety with a firm and stable fruit. The size is rather underneath average. Yield is in the medium field. Favori convinces with a beautiful picture of the skin. With respect to the taste this is an interesting variety, especially for direct marketing.
5,5	6	6	19	Interesting novelty with good flavor and attractive fruits. Suitable for all ways of marketing
5,2	5,5	6,5	19 – 21	Well-flavoured variety with attractive fruits and good flavour. Very mildew prone!
5,2	6	6	18	Interesting variety with a medium to good taste. The yield is high with fruits of medium size. The attractive looking fruits show a good durability. Murano is one of the standard varieties for Table Top systems
5	6	6,5	19 – 20	Profitable variety with medium red, glossy fruits. Furore produces fruits which are of medium size, evenly formed and with a beautiful picture of the skin. The taste of this variety is only of medium quality and slightly underneath average. Good variety for the wholesale market.
4,8	5,5	7	19 – 21	High yield and a nice picture of the skin make this variety interesting. The fruits have a nice gloss to them and the firmness is very good. The taste is in the medium field. Malga is especially suitable for the wholesale market.


Murano


Hademar


Malga



Everbearer plant types:

We produce various different plant types of everbearing strawberry varieties.

In addition to various grades of cold-stored (frigo) plants and potted fresh plants, we also offer tray and mini tray plants. Tray and mini tray plants are pre-cultivated plants with pot soil. The main difference between mini tray and tray plants lies in the size of the pot, with the result that tray plants are expected to produce more trusses in the autumn.
In addition to pot size, the planting date at the start of plant production also has a big effect on flower emergence and the timing of subsequent cropping. By producing runners in Morocco or even further south, it is now possible to realise very early planting/production dates.

Later handling of the ready tray plants also gives rise to large differences in the timing of growth during later fruit production.
While in the past, tray and mini tray plants were usually stored in a cold store at 2 °C, there have been promising trials of plant types overwintered in a frost-free environment ('ambient').
We would, however, like to explicitly draw your attention to the fact that not all of the plant types/cultivation systems described here are suitable for use in every location or on every farm. These crops are highly specific and extensive consultation is required. We recommend coordinating closely with your horticultural adviser right from the planning stage.

We would like to offer a brief introduction to the various everbearer plant types and to potential cultivation systems:

Fresh potted plants (early harvest)
- plant in August of the previous year (overwinter!)
  - plant availability assured
  - growers need to consider the risk of winter frosts
- grow in substrate for an early crop
- very high potential yield
- harvest with full yield completed by early August
  - can then be replanted

Fresh potted plants (late harvest)
- plant in August of the previous year (overwinter!)
- low-cost outdoor cultivation for a late crop
  - mow off the first flowers/leaves
  - the second wave of flowers comes much earlier
- medium late to late cropper
  - affordable alternative to deep straw, 60-day plants, etc.
  - alternative to late varieties (e.g. Magnus, Malwina)

Mini tray plants (standard)
- plant in early spring or summer (2nd planting, e.g. after waiting bed 'heavies')
- grow in substrate for an early crop
  - the autumn flowers crop (1-3 trusses)
  - after a pause in cropping (depending on the variety/weather conditions), there will be 2–3 waves of crops continuing into the autumn

Tray plants (standard)
- plant in early spring
- grow in substrate for an early crop
  - the autumn flowers crop (2–4 trusses)
  - after a pause in cropping (depending on the variety/weather conditions), there will be 2–3 waves of crops continuing into the autumn

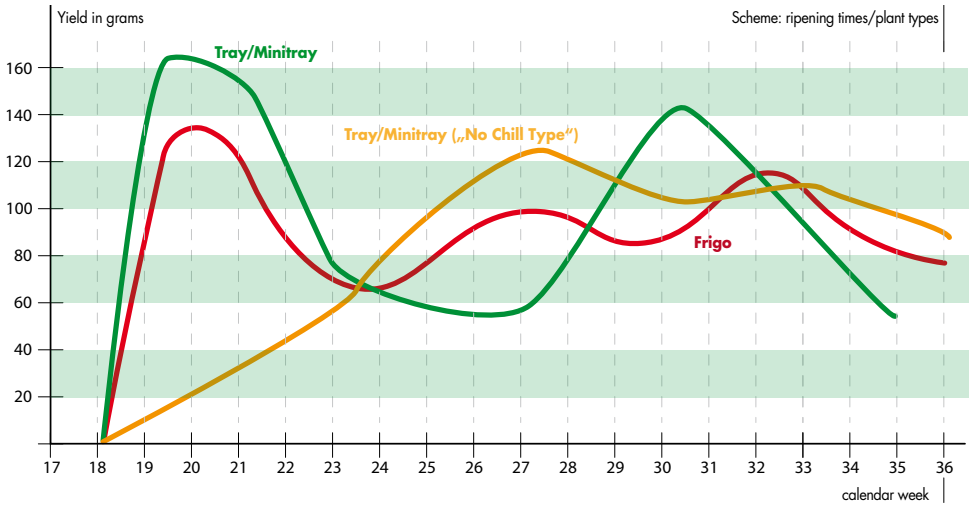
Tray/mini tray (ambient)
- plant in late January/February
- grow in substrate for an early crop
- with suitable varieties (Favori, Florice), the plants crop much more evenly than standard plants
  - the pause in cropping after first picking is significantly shorter
- better overall fruit quality
- plant production is significantly more expensive
- increased risk of disease (overwintered in a greenhouse)
- plant delivery is confined to a narrow, predefined time window

Tray/mini tray ('no chill' type)
- plants are produced in January/February
- plant around mid March
- grow in substrate for a medium early crop
  - no autumn flowers for cropping, so cropping starts later
- even cropping from approx. mid May
- combines well with standard mini tray/tray plants
- significantly less labour needed for growing (e.g. foliage removal)
- uniform, even fruit quality

Cold-stored (frigo) plants
- for planting in early spring
- grow outdoors in natural soil
- grow in substrate gutters for a late harvest
  - the first flowers are usually removed to help establish a strong root system.

Tabletop strawberry production systems in Germany are in the ascendancy. The more comfortable picking conditions result in higher picking speeds, making this a good option for keeping the lid on rising labour costs. Growing use of tabletop production systems is also boosting the popularity of growing everbearing varieties. This plant type enables growers to achieve their target per meter yield with just a single planting.
For fruit producers, the goal with this production system is to achieve the most even harvest possible from April through to September. Of course in reality things don't always turn out exactly as planned. Whilst with tray/mini tray plants growers can predict the date of the first crop relatively accurately, the prognosis for the second and third crops is less predictable. This is due primarily to the unpredictability of weather conditions, but also to differences between plant types.

When planted, both tray and mini tray plants carry the trusses initiated the previous autumn. You know you're going to be able to start harvesting roughly 60 days after planting. During this period, everbearing varieties can produce new trusses for a second crop. This depends, however, on daylight and temperature.
A further, in recent years increasingly noticeable influence on the timing of truss production is the number of chilling hours to which the plants used are exposed.



It has been shown that the length of time between the first and second cropping periods is significantly longer in plants that have been exposed to a severe cold stimulus.
Experiments with frost-free and warm over-wintered tray/mini tray plants have shown that the breaks between flowering are significantly shorter when the plants are exposed to fewer chilling hours. This observation has led to the idea of producing a "no chill" plant type. The "no chill" plant type is a fresh potted plant planted in January/February which doesn't have any autumn trusses and has not been exposed to cold.
The way these plants develop differs markedly from the familiar tray/mini tray plants. The plants are delivered in February/March and develop similarly to fresh potted plants. This is followed shortly afterwards by very uniform flower and leaf formation. The first fruit can be harvested from mid May. This type of plant also offers advantages in terms of fruit size and flavour. The harvest is much more even than with standard tray/mini tray plants, with maximum production from June to September/October. This cropping window means farmers can be assured of reliable summer production.
A further advantage is that this plant type requires less cleaning work, as foliage development is much more even.
In combination with a crop that covers the very early harvesting period, the "no chill" plant type can help ensure an even level of production.

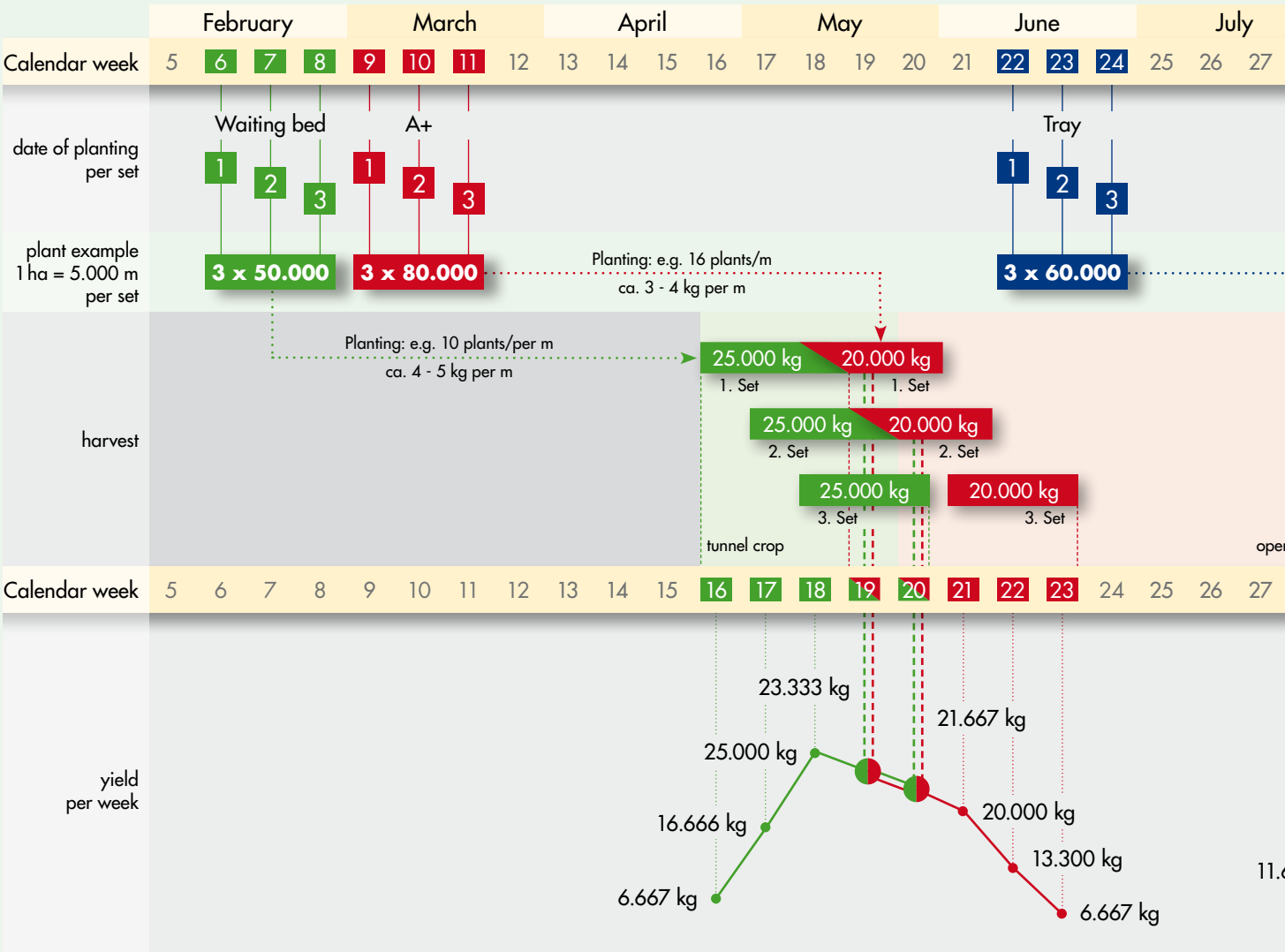
The right plant material for a successful cultivation

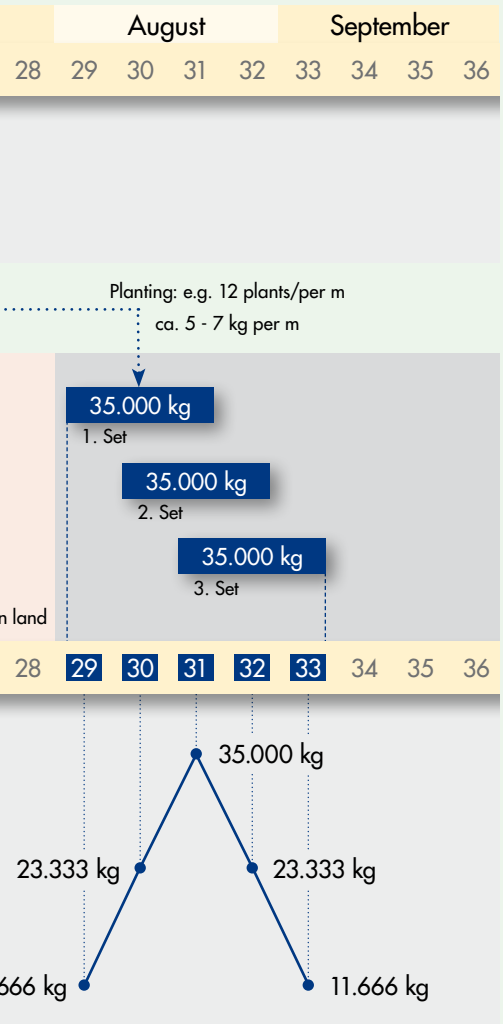
Unfortunately when it comes to discussing prices and delivery terms etc., the most important reasons for buying in the first place are soon forgotten. Healthy seedlings are an essential requirement for successful cultivation. Difficult to combat weeds and pesticides should certainly not be found among healthy young plants.
The choice of seedlings is usually determined by wheather or not to use fresh plants or frigo plants. If frigo plants should be chosen there are many varieties and types of plants available.
The individual plant types and their characteristics will be briefly presented below.

PLANT TYPES	PLANTING TIME	SOIL	COMMENT
Fresh plant	July/August	open field, Substrate	early crop, best taste
Potted fresh plant	July/August	open field, Substrate	easy planting in substrate
Frigoplant – Frigo A-, A	March-July	open field remove the flower trusses	
– Frigo A+	60-day culture	open field, Substrate	
Waitingbed plants	60-day culture	open field (raised bed), Substrate	60-day for early production avoid stress through hot temperature
Trayplants	60-day culture	Substrate	Tunnel- Glasshouse production
Everbearers:	autumn, spring	Substrate	Table Top systems

See also page 28/29

Harvest planning by the example of a terminated culture with different plant types.





The graph shows a possible plan for a terminated culture.

The individual objective of when and where the harvest should take place is different for every business. In this example, the objective is the planting of strawberries before and after the open land harvesting time. The graph doesn't lay any claim to completeness and is only supposed to be some advice.

Basically, with the terminated culture we work with different „plant approaches". For every set it is possible to use different plant types. Depending on the plant type and the season of the year, the individual sets need between 7 – 10 weeks to start with the harvest. (See choice of plant types). This is also important when choosing a variety.

Choice of plant types:

- The earlier the date of planting the heavier the plants can be
- The number of plants per meter (linear metres) is depending on the inflorescence (60 blossoms/linear metre)
- When choosing later dates for planting, only tray or A+ plants are possible (heat stress can cause small fruits)
- The harvest for the next year needs to be taken into consideration (date, power of plants)

Requirement of plants: (Depending on inflorescence)		
A+ plants:	14 – 16	plants/linear metre
HWB plants:	8 – 10	plants/linear metre
MWB plants:	10 – 12	plants/linear metre
LWB plants:	12 – 14	plants/linear metre
Tray:	10 – 12	plants/linear metre
Tray (on going cultivation):	8 – 10	plants/linear metre

The harvest of the individual sets spreads over 3 – 4 weeks of harvesting.

Fresh plants

Fresh plants are offshoots, that need to be planted in the soil as soon as possible after they have been separated from the mother plant. Date of planting is usually the end of July beginning of august, depending on weather conditions and plant developement. These plants have a leafy appearance while growing, and are mostly planted and thrive best in hot weather conditions. Due to the fact that the delicate rooting of the plant may be damaged when being extracted from the soil they can, at first have a problem to absorb water. Fresh plants must be watered regulary until sufficent suction and fiber roots are thriving. These plants must be sufficently developed by autumn in order to produce enough foliage for assimilation, and this is very important for the induction of flowering which takes place between late September and early November. The yield potential of the plant is determined during this period. If the plants are set early and have a long induction period this will increase flowering. In return this will result in a very high yielding selection, yet although the plants have a very large appearance, the yield is rather small.

Thus the optimal planting period for green plants differs from region to region.

In the past the motto was „the sooner the better". But nowadays, especially in the southern regions of Germany, planting takes place quite late in the season. This enables an early harvest the following year with large berries.

Potted Fresh Plants

Potted fresh plants are harvested between early to mid July. They are harvested as unrooted cuttings and then potted. During the first few days after potting, the transplanted plants are constantly kept under sprinklers until sufficient roots have devoloped. Delivery of these young plants can commence as soon as the pots are fully rooted (end of July the beginning of August). Potted fresh plants have a significantly higher leaf and root ratio. It takes a long time for these plants to become dehydrated, and even though they are higher priced and transport costs are also higher, this is quickly matched by the secure growth and developement of the plants, which is certified.
Yields of such plants are not higher than those of optimal planted fresh plants, but production reliability is much higher.

Potting Trays

We here at Kraege have two different kinds of potting systems when it comes to our young strawberry and raspberry plants. Our first system is a styrofoam tray which houses 68 berry plants. The second system consists of a reuseable tray for 66 young plants.
In the future we will be expanding the use of reusable trays considerably. We see this system as a contribution to the enviroment. A small deposit will be charged for the reusable trays when the plants are delivered, and this same sum will be returned when the trays are returned back to us.

We would be very happy to support you when returning the potting trays to us by organising transportation if needed.
Hygiene is extremely important at our plant production premises. Therefore all the returned trays are not just throughly cleaned, but are also disinfected.
This way we can be sure to exclude the possibility of transmitting diseases to the plants by means of the potting trays.

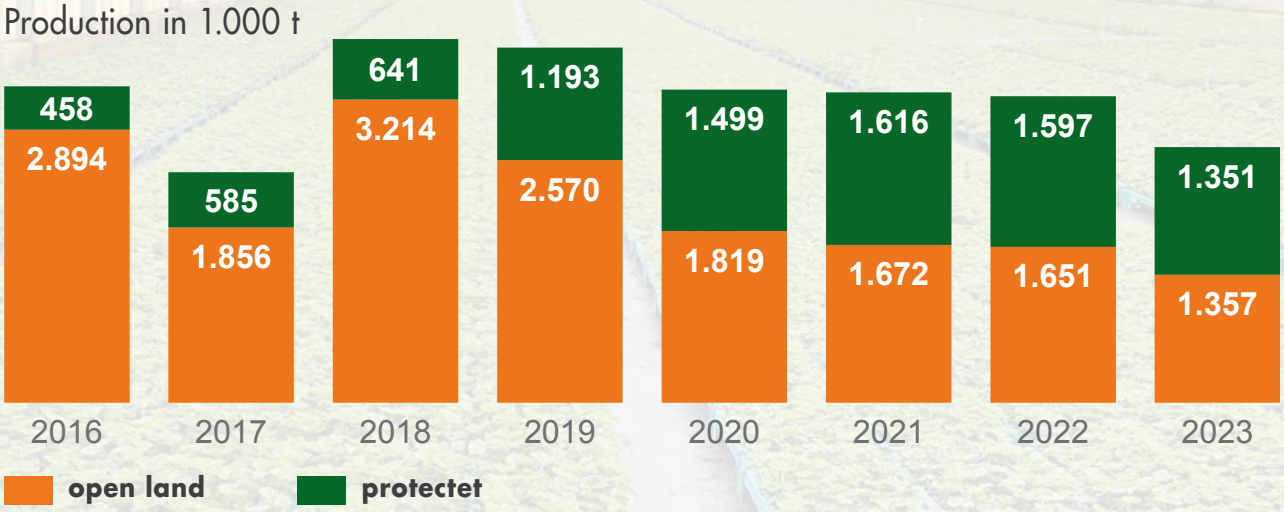
Organic plants

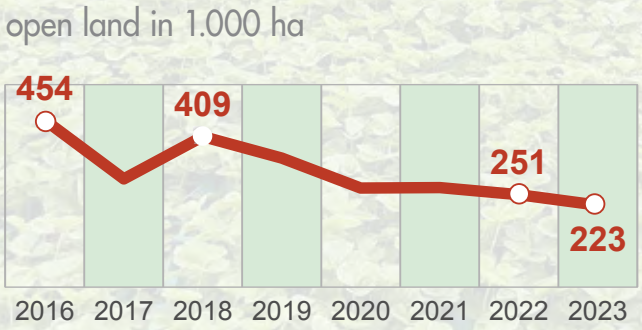
The company „Kraege Biopflanzen GmbH & Co. KG" was newly founded in 2020. (DE-ÖKO-006). With this company we want to comply with the increasing demand for organically produced plants. A growing market for organic plants can be observed in the hobby area (garden centers,...) as well as in the professional field. We see it as a challenge to offer the high quality which we ensure with our conventional plants also for the organic field.
On the part of the consumers, the request for organically produced strawberries will continue and most likely increase in the next years. Besides, the underlying conditions for strawberry production will change in favor of sustainability and biodiversity.
Using potted green plants, we started to work in this line of business. With this type of plant, we have the possibility to offer a wide spectrum of varieties in coordination with the demand of the customers. At a separate location, the plants are cultivated under the "EU eco regulation". In the last two years we have successfully distributed the first organic potted green plants.
It is planned to further expand the production in the next years according to the request of the customers and to include tray plants in the future.
A production of these plants takes place only when pre-ordered (order date for potted green plants until June 15th).
Currently most popular varieties:
Allegro, Glorielle, Asia, Sonsation und Malwina.
Nevertheless, according to prior agreement, many other varieties from the Kraege-program are available.
The installation of a frigo plants cultivation with organic quality is not planned for the next years, because in order to do so all of the pre-material (mother plants, etc.) would have to be implanted in organic quality and also tested and certified by the "EU eco regulation".
We want to build this line of business in close consultation regarding varieties and plant typed with customers who are interested.
Torsten Gerling is responsible for the production of organic plants. At Kraege Beerenpflanzen, he is also in charge of the whole frigo production.
The area of sales and customer service now took over Martin Hertleif.

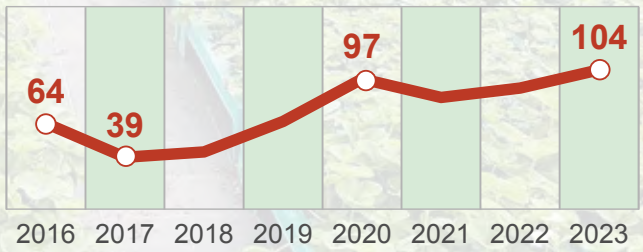
AMI

More organic strawberries from protected cultivation

Production and production area from organic straberries in Germany in order of cultivation method.







If you are interested in our organic plants, please feel free to contact us!

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Dr. Christina Neuhaus
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KRAEGE
BIOPFLANZEN

Growth in under cover organic strawberry production continues unabated

Almost half of all organic strawberries grown in Germany are now grown in greenhouses and polytunnels. That's a significantly higher proportion than for strawberries from conventional production, 70% of which are still grown outdoors. Despite further increases in the area grown under cover, 2023 did not see any increase in the total organic strawberry harvest. Poor weather, with low light levels and low temperatures, limited yields even for crops grown under cover.

The trends in growing areas seen in recent years continued through 2023. The outdoor area under cultivation fell by over 11% to 223 hectares, while the area grown under cover hit its highest ever level at 104 hectares. This was a 15% increase from the previous year alone. This means that the area grown under cover now represent almost 32% of the total area under cultivation for strawberry production. This also showcases the fact that crops grown under cover produce significantly higher yields, since roughly 50% of the total harvest came from greenhouse and polytunnel production.

Frigo Plants

Frigo plants are kept in cold storage. In mid November the plants are harvested, sorted and deep frozen. During this period of time the plants remain dormant. Due to the fact that the plants are given a longer time to develope before harvesting, they have much stronger roots.

The frigo plants are then sorted by the thickness of the rhizome, and this in turn gives an indication of the number of inflorescence each single plant will produce. Grading should be determined by the diameter of the rhizome and not by the number of plants in the box, as a variety of boxes are in circulation.

Grading of Frigo Plants

- **(A++) Plant (as of > 18 mm)**

- **(A+) Plant Sorting (15mm)**
  This is the most planted grading for 60-day cultivation. This planting takes place approximately eight to ten weeks before harvesting. Perfect watering conditions are an important factor for the success of this complex cultivation system.

- **(A) Plants (10 – 14 mm)**
  The most planted grading where harvesting is possible the same year of planting. This of course will reduce the yield the following year. We would recommend to break off the flower trusses blossom in order to ensure that no fruit can thrive.

- **(A-) Plants (8 – 10 mm)**
  This plant is perfect for light to medium soil. We would also recommend you to forgo harvesting the first year and remove the flower trusses. Early planting is also recommended.

- **(B-) Plants (6 – 8 mm)**
  Ideal plant type for potting for nurseries and garden centres.

- **Waiting-bed-plants.**
  Waiting-bed-plants are most suitable for 60-day cultivation and greenhouse culture. There are three varieties/grades available

Light	(15 – 18 mm)
Medium	(18 – 22 mm)
Heavy	(> 22 mm)

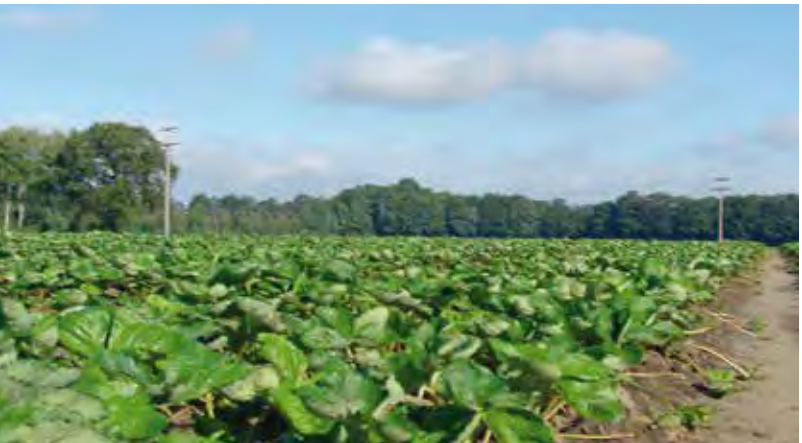
Orders need to be placed by the 30. May. See page 66 for details.

Waiting bed plants: You can order different varieties

Waiting-bed-plants are exclusively produced from fresh plants. These plants are harvested by hand round about mid July and are then planted directly. Therefore an almost undisturbed growth process is guaranteed.

Not all varieties of plants are suitable for this kind of cultivation. Approved plants must be capable of producing sufficent inflorescences during the autumn period. After planting takes place in spring, approximately 60-days elapse before harvesting. The plants themselves must produce sufficient roots and leaves within a short time in order to be able to care of their fruits. If inadequate care is given the size of the fruit will be inferior, therefore a dissapointing yield. Irrigation using a drip irrigation system is mandatory.

The most suitable varieties for waiting bed cultivation are Elsanta, Sonata, Malling Centenary, Flair, Rumba, Sonsation, Falco, Elegance und Malwina.



Waitingbed plants are offered in the following gradings

Light	(15	–	18	mm)
Medium	(18	–	22	mm)
Heavy	(	>	22	mm)

Waitingbed plants are especially suitable for Greenhouses, and 60-day cultures

Tray Plants

Production of the tray plant begins much like that of the potted fresh plant. Unrooted Tips are harvested and potted under irrigations systems. In comparison to potted fresh plants however, which are delivered as soon as possible after rooting has been completed, the tray plant remains on the tray field in its tray until the winter dormancy period begins.
This allows the plant to inflorescence the Flowers in September-October (comparable to waiting bed plants). During dormancy the plants will be placed in cold storage and frozen at a temperature of -2°C.
Tray plants have a harvesting potential comparable to that of waitinbed plants, and are extremely suitable for 60-day cultivation in greenhouses.
Tray plants are easier and quicker to plant in a substrate, and it is a great advantage when working with the later sets under warmer conditions. Due to the rooted pot ball, tray plants have significantly less stress in hot temperatures in comparison to other plants. This has a positive effect on the growth and size of the fruit.
This complexed grown plant has it's price, and the cultivation method used is also costly, especially when compaired to the normal open field produced plant.

Orders need to be placed by the 30 May. See page 66 for details.

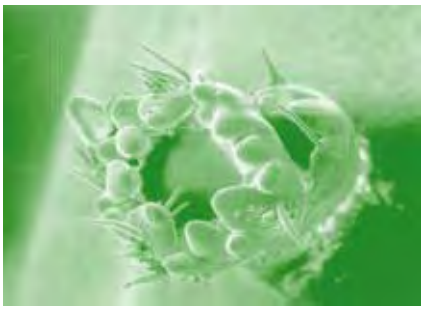
So in order to make this kind of plant profitable the potential yield must be as high as possible and the yield itself must be guaranteed.

Sometimes, especially when dealing with the well-tasting-varieties, the yield can be very low, if this be the case early planting of the Tips is the secret to the successful production of a high yield tray plant.

To ensure an economically successful yield, the potential of such plants must be fully consumed. Therefore an extensive consultation regarding temperature, fertilization and correct planting dates etc. is of utmost importance.
Production and storage of this plant type is quite complicated, and consequently more expensive. Accordingly, the required amount of plants should be preordered in June/July of the previous year.

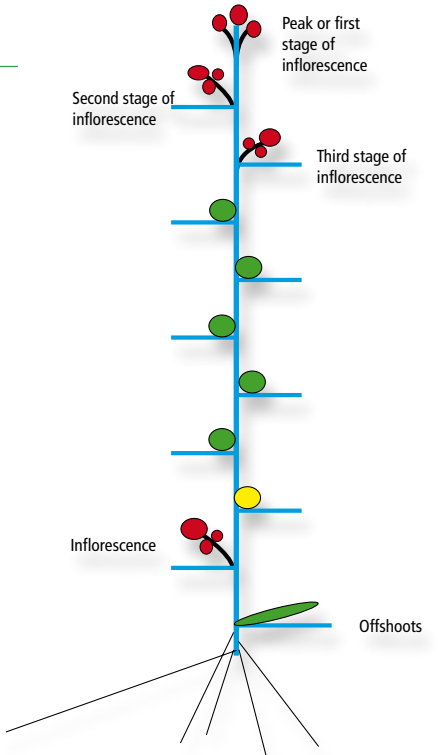
Flower Mapping

60-day cultivation of strawberry plants has greately expanded in recent years, and this method is very important in the substrate culture area.



Quelle: plantalogica.nl

Meanwhile the examining of the individual plants for the number of inflorescence has become a standard procedure.
Random examination of the individual varieties and rhizomes are constantly carried out on the plants until vegetation, which occurs in autumn is visable. Vegetation is assessed accordance to leaf, offshoots and blossoming, the different stages of developement is also an important factor. A final evaluation shows the number of inflorescence and their length, these results are then transferred to a chart.



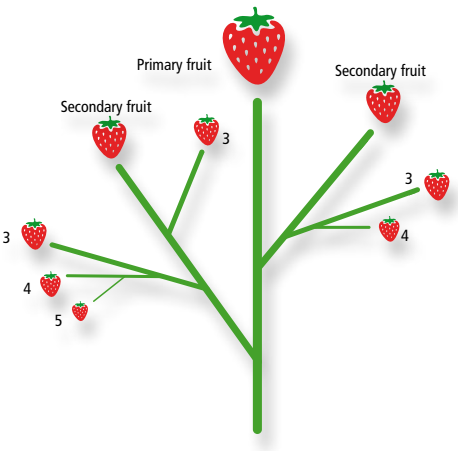
Key points to consider for tray/mini tray plant orders

For strawberry production using tray/mini tray plants, there are a number of growing options. For a successful crop, the plant type needs to be the best possible fit for the planned production system. Tray/mini tray plants are a natural product, are weather dependent and vary from year to year. That we the plant producer remain in close communication with you the customer, right from placing your order through to production and delivery, is therefore essential. Reviewing the status of the plants in December is very important for adapting growing plans to actual production status.

1. Your thoughts and requests when ordering plants: (By May 15 of the previous year)	2. Joint plant review on lifting plants: (During December/January visit)	3. Agreed plant delivery (Checked by customer)
- Number of plants/availability - Plant type - Storage	- Check number of plants - Check plant type - Storage costs depending on duration	- Check number of plants - Check plant type
Plant health: - Certification - Root health - Insect infestation	- Field visit at producer - Testing on request	- Certified material/ Agricultural chamber - Plant sample - Testing
Internal/external values - Number of crowns - Flower emergence - Lifting date - Chilling hours (number)	- Number of crowns is determined - Flower mapping (random samples) - Agree lifting date - Agree chilling hours	- Check agreements - Flower mapping
Delivery date - Planned delivery date	- Provisional delivery date	- Call for delivery (approx. 1 week in advance)
Billing - Down payment on order confirmation - Non-propagation agreement (NPA)		- Payment of outstanding balance after delivery - We must have an NPA prior to delivery

During the whole of this process the different stages of vegetation developement are rated on a scale of 1 – 7. While the upper shoot area already produces inflorescence during stage 1, the lower shoot area must reach a value of over 5. "Flowermapping" is a very time-consuming method, and therefore quite expensive. It is also only possible to examine a small number of plants of the total quantity produced.

The real reason behind this method is to have an insight at a certain developement point. The number of flowering plants found is no guarantee of inflorescences that will later develope in the crop.



External factors, such as weather etc. during cultivation have a considerable influence on the actual developement of inflorescences and their length.

Nevertheless, the flower mapping method is certainly justified. Based on the results expected, planting distances can be adjusted to suit the numer of inflorescences predicted. In addition, the distribution of the blossoms around the budding /shoot area allows conclusions to be drawn as to the course of the harvest (compact/ spread). Results of an inflorescence study during the early phase of flower induction can be used to coordinate a fertilisation programme.

Runners/tipss

The last few years have seen a big increase in demand for potted strawberry plants. For almost all hand-planted crops, the preferred planting material is **fresh potted plants**. Higher plant cost is offset by the time saved during planting and faster growth when growing on.
Large numbers of runners are also required to produce **tray** and **mini tray plants**.
In addition to the various different types of runner, early availability of runners is the key to reliable strawberry production.
For fresh potted plants, early planting is essential for producing well-rooted potted plants for early delivery.

For tray plant production, early planting means a longer development period. This is very important for ensuring the strongest possible plants with lots of branch crowns and a high potential yield.

For everbearing varieties, very early availability of, for example, 'no chill' runners makes possible completely new plant types/cultivation systems. There are various methods for propagating runners, producing a range of different planting materials.

Greenhouse runners

– produced in a greenhouse (gutter, hanging runners)
– stolons are parallel to the leaf shoot
  - a little more difficult to plant
  - can be supplied very early
– Availability:
  - Germany/Netherlands grown: June 25th to July 25th
  - 'No chill' production: January 15th to February 15th

Outdoor runners

– produced in an outdoor propagation field
– stolons are at right angles to the leaf shoot
  - easier to plant
  - reduced risk of failure
– Availability:
  - Morocco grown: May 15th to June 15th
  - Germany grown: June 15th to July 15th

Tip propagation on Morocco

Since 2019, Kraege Berries produces Tips in Morocco. In order to do so certified Kraege mother plants are planted on fields in Morocco to reproduce. After a very short time of cultivation, multiple cuttings can be taken from the mother plants only a few months later. The harvested Tips will then be brought back to Germany and then be used as tray or waitingbed plants. With this extremely early date of planting we create all the requirements for a production of a strong plant with a suitable number of inflorescence.

This is especially interesting for the M. Centenary variety, which doesn't grow many inflorescences under normal conditions. The plants are controlled at all times and later certified in Morocco as well as in Germany.

The cultivation of plants in Morocco ensures a high-quality harvest of cuttings from an early date on. As soon as May starts, very even and healthy cuttings can be harvested there from open land cultivation.

Substrate cultivation

A special method of strawberry cultivation in greenhouses, tunnels or even under rain-shelters is substrate cultivation. This kind of cultivation offers the possibility to use already constructed tunnels repeatedly. The complex mounting and dismounting of tunnels is no longer necessary. Locations can be chosen freely without considering the natural soil conditions or diseases that might be found there. As the name already suggests, the strawberry plants are planted in substrate. There are various suitable kinds of substrates available, generally pot or coconut substrate are used. It is very important to chose the correct substrate structure for each plant type. An appropriate drainage capacity of the substrate during cultivation is of great importance, therefore a water sample should be taken and examined. The calculated values are especially important when planning methods of fertigation and irrigation.

Substrate can be used for many different cultivation techniques. The simplest form of all is to construct dames at the chosen location, bags of substrate are then distributed along the raised beds, and planting takes place directly in the foil bags of substrate. In recent years, this so called „substrate gutter" system has become increasingly common.

A dam is constructed by using a special dam-rotary-maschine, which formes a channel in the middle of the dam, the channel can then be filled with substrate. The channel is fitted with an anti-root cloth, and a drainage gutter is also laid. In order to achieve the required results, not only is the necessary machinery needed, but a lot of experience and know-how.

More elaborate, however more convenient when harvesting, is the table top system. A very high picking performance can be achieved, which makes this kind of cultivation system very interesting in times of increasing labour costs. There are no limits to the imagination when constructing this kind of system. Foil bags are filled with substrate and can then be placed on the system which can be built from plastic crates, pots, wooden boxes etc. All systems are then irrigated with the help of a drip like hose.

You should bear in mind when planning to use the table top system, that harvesting commences a few days later in comparison to that of the soil cultivation method.

Depending on the kind of cultivation method used, potted fresh plants, strong Frigo (A+/++) plants, waiting bed plants or tray plants can be selected.

The potted fresh plants are planted in August and are then cultivated throughout the winter period. Depending on the variety of plant, 10 plants are sown per running metre. Usually early known varieties such as Clery, Flair and Malling Centenary are planted. These varieties These varieties are known to produce an early yield of 3 – 6 kg per running metre the following year. After the harvest the tunnels can be used again, this time with ever-bearing, or

waiting bed varieties for a second harvest.

For on going cultivation using waiting bed plants and a table top system, 10 – 12 plants per running metre are planned round about the 10 July.

Harvesting can then commence the end of August beginning of September. A yield of 4 – 8 kg per running metre can be then expected. A second harvest follows the middle of May the following year varieties such as Elsanta, Sonata, Clery and Malling Centenary are the

more suitable types for a table top form of cultivation. It is becoming more and more common to plant waiting bed plants in spring (from Febuary) for one time harvesting. However, this kind of cultivation can only be profitable if direct marketing prices are high.

The planting distance should be carried out in such a manner, that approximately 50 flowers can be harvested per running meter. The expected yield should be at least 4 kg per running meter in order to be cost-efficient. Considering the cool spring weather conditions, waiting bed plants or tray plants are a good choice, and there is no difference in the yield and the quality of the fruit. Both varieties are known for their significantly low price. For later harvesting under more hotter and stressful weather conditions the tray plant is at an advantage, as it can cope more easily due to its more balanced leaf-root ratio.
When it comes to tray plants, here too it is intended to be able to harvest roughly 50 inflorescences per running meter. It is possible to prolong harvesting until the end of the year if planting takes place in a heated greenhouse. When employing this kind of cultivation, tray plants are generally sown from mid- August for harvesting in mid-October. After a hibernation period, the greenhouse is then reheated the middle of Feburary, and a second harvest occures in mid-April.

In the open fields, pollination is naturally taken care of by free roaming bumble bees and bees. However, this is not the case when it comes to greenhouses and tunnels. Here, bumble bees are set free by hand. The bumble bee is better suited as it has no problem in flying even in cooler weather conditions, and has a better sence of direction in tunnels. Colonies of the bumble bee are released in time before blossoming begins (one colony per 1,000 m²)

As an alternative, a vacuum sweaper can be used to cause artificial pollination.
Basically, it must be said that this very complex cultivation method requires not only the necessary know how, but also years of experience.

It is essential that when cultivation commences that all kinds of flooding and moisture of any kind should be avoided when regulating the irrigation system to be used. After moistening, the plants are then set, watering is initially carried out two to three time a day, every two to three days. After been given a little time to develope, irrigation can be carried out up to ten times a day, sewage or waste should lie between 5 – 10%.

Even the smallest of mistakes can cause large financial losses. Therefore it is important that

all fertilisation and irrigation systems be calculated together with a cultivation expert, and this also goes for all necessary plant protection measures.

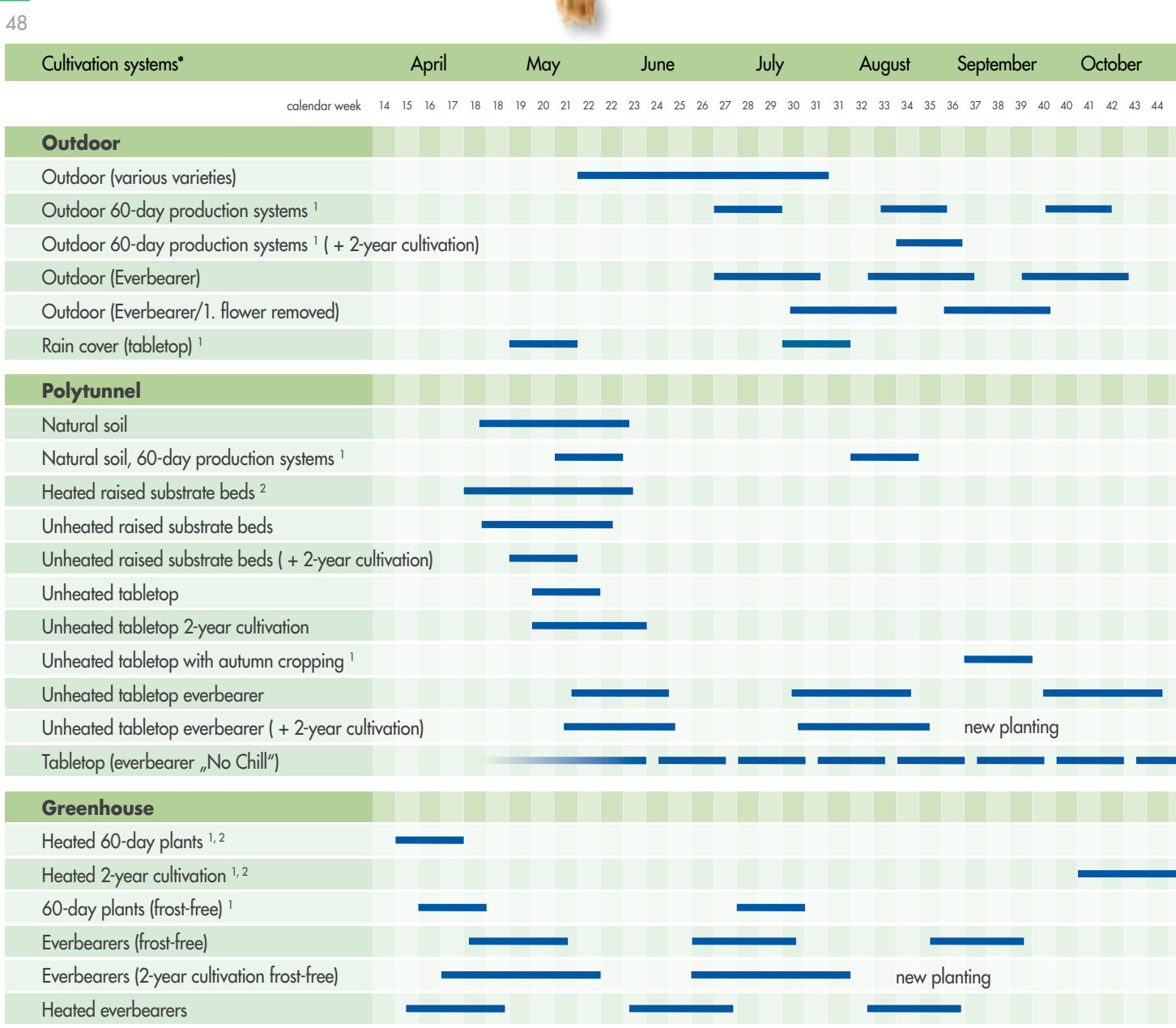
Irrigation and fertigation for substrate cultivation

A well-developed irrigation and fertigation plan is very crucial for a successful substrate cultivation.
Before planning can be carried out, local conditions must be observed. Phase one involves testing the water supply, with the help of a water appraisal.
In addition to maximum values for irrigation water, the technical references also provide information on specified values on the majority of elements found in the substracte.
All maximum values and test results should be evaluated together with a specialist, in order to obtain the best irrigation and fertilisation concept possible for your crops.

Water and fertilizer are administered to the substrate by means of drip-lines, or individual drips. The rate and frequency of irrigation depends on the stage of growth of the plants themselves. This procedure can take place up to 12 times a day, throughout the whole day, starting at approximately two hours after sunrise, until two hours before sunset. The volume of sewage should be around 5% in cloudy conditions, and up to 25% in warm sunny weather. The monitoring of incoming and outgoing water is based on EC regulations. The intended levels lie between 1.4 and 1.8 mS.

EC evaluations specify the conductivity of the water for electricity. This is measured in milliSiemens (mS). The more particles dissolved in the water, the easier it is to conduct an eletric current. While the conductivity for distilled water is zero (EC=0), the level rises with the increasing concentration of the contained substances (e.g. potassium and magnesium). The EC value only indicates the total concentration of the solution/liquid, but not the concentration of the individual components in the solution.
The EC rating of sewage should correspond approximately to that of the water supply.

If levels should rise significantly, this is an indication that the substrate is oversalted. This can be counteracted by increasing the volume of water administered. However, it is imperative not to moist the substrate. EC levels should be calculated and documentated every day at the same time, if possible. This allows the developement of the cultivation to be monitored closely, and if necessary, counteraction can be taken promptly.
We would recommend you to seek advice from an expert as to whether an all-nutrient fertilizer or, individual nutrients with added elements in particular of potassium an nitrogen are allowed to be administered at your location of cultivation.
In addition to all EC standards, the pH value should also be kept in mind, this should lie between 5.5 and 5.8.
If pH levels are too high, this will reduce the plant's ability to absorb micro-elements (e.g. iron), and this in turn causes damage to the roots. The pH value of the water is determined by the hardness of the water, and the buffer capacity of the substrate.



When do I want to sell strawberries on my farm? Can I afford not to have strawberries if other farms are selling fruit?

In which periods have the best prices usually been achieved? Can I afford not to sell strawberries during well-known low-price periods?

These are just some of the many questions a farm manager needs to be thinking about when planning their strawberry harvest. The answers will vary from farm to farm. While farms selling direct to the consumer need to have as long a season as possible with strawberries with good flavour properties, farms supplying to retail need to focus on yield and prices achievable on the open market.

November	December	Jan.	Febr.	March	April	May	June	Plant type	Plant type
44 45 46 47 48 49 50 51 52 1					14 15 16 17 18 18 19 20 21 22 22 23 24 25 26				
								June-bearers	fresh, Frigo A
								June-bearers	Frigo A+ / A++ / WB
						———	———	June-bearers	Frigo A+ / A++ / WB
								Everbearers	Frigo A / A+
								Everbearers	Frigo A / A+
								June-bearers	A+ / A++ / WB/Tray
								June-bearers	potted fresh, Frigo,
								June-bearers	A+ / A++ / WB/Tray
								June-bearers	potted fresh, Frigo
								June-bearers	potted fresh, Frigo, Tray
						———	———	June-bearers	Tray / WB
								June-bearers	Tray / WB
						———	———	June-bearers	potted fresh, Frigo
								June-bearers	WB / Tray
								Everbearers	Tray, Minitray, Frigo A / A+
								Everbearers	potted fresh
								Everbearers	potted fresh in Jan./Feb.
								June-bearers	Tray / WB
———					———			June-bearers	Tray
								June-bearers	Tray / WB
								Everbearers	Tray, Minitray
								Everbearers	potted fresh
								Everbearers	Tray, Minitray

[1] 60-day production systems = harvest 60-days after planting
[2] Temperature dependent

Many farms operate both models and successfully exploit the increased flexibility this allows.

Farms selling direct to the consumer need to always have enough strawberries for their customers. The risk of customers going elsewhere is simply too great. This factor tends to lead to some overproduction, for which the farm needs to have a sales channel ready where needed.
If you're selling to retail, the key to success is having the right volume at the right time. Agreements and plans are concluded with retailers sometimes well before the season starts. For producers, retailer requirements can be hard to meet.

Every farm has its resources, which you as a farm manager need to use as efficiently as possible, whilst constantly developing further.

Your planning for the season will only be successful if you know what quantities you are planning to harvest month by month. This raises the question of availability of outdoor growing space or space under cover. What do you need in order to be able to produce a crop within the planned harvesting period and what production volumes can you achieve? Where would it make sense to invest some capital to help the farm remain competitive and ensure long term success?

Do you have enough workers for the individual cropping periods on your farm to be confident that you will be able to bring in the harvest? Will you be able to get hold of additional workers to carry out any planned new cultivation projects?

What are the risks involved in your cultivation projects and is the scale of investment required manageable for the farm? Under-cover production systems require a lot of investment, but enable you to plan your production more reliably.

Even with the most careful planning, every season is different, and is affected by lots of other factors that are difficult for you as a grower to predict. The overview above is intended to throw out a few ideas and illustrate the variety of growing opportunities.

* In each individual case, the local conditions must be taken into account.

Direct Marketing/Wholesale marketing which is the more suiteable variety?

Nowhere in Europe are so many strawberries sold directly from the producer to the end consumer as in Germany. This takes place through simple side-of-the-road stalls/booths, or quaint little farmhouse shops that offer a large assortment of strawberries all year round. The willingness of customers to pick their own strawberries has declined in the past. On the other hand it might be worth thinking about pick-your-own strawberry fields, as the experience of pick-your-own is becoming more and more attractive nowadays. In addition self-picking strawberry fields are an excellent location from selling already picked fruit. It is also an important factor that the customer knows where your business is located, which is why every form of advertising is extremely important. Farm festivals and festivals for the opening of the strawberry season are just a few named opportunities for your customers to „taste" for themselves that your strawberries are the most succulent, delicious and largest in the region.

Remember your strawberries need to be more convincing than those of your competitors. Attractive signs, and booths and not to mention reliable opening hours are further important requirements in gaining customers trust. The customer expects fresh succulent strawberries, that have a clearly higher quality in both taste and appearance in comparison to those found in the supermarkets, therefore the consumer will be prepared to pay a comaratively higher price in order to aquire such a high quality product. In addition to the direct marketing of strawberries the retail trade should also be taken into consideration. During the strawberry season customers expect to be able to buy high quality fruit at a reasonable price both in supermarkets and discount stores. Advertising campaigns are a great opportunity for retailers to attract

customers to their stores. Unfortunately this option can also lead to the annual competition for the lowest prices.
In recent years retail prices for strawberries during the peak season have been far too low at times, especially when compaired to production costs which have risen significantly year for year. Minimum workers wage has contributed enormously to significantly higher harvest costs. So in order to survive this kind of price war, certain characteristics such as harvest, fruit size and picking performance are of upmost importance when planning cultivation for this kind of marketing/merchandising. In addition to an attractive product display a long shelf life is particularly important. Each and every complaint can cause a big set back in profits.

When comparing direct marketing to commercial marketing it becomes quite clear that each have their own special requirements and characteristics. The only common feature both forms of marketing have, is that both versions need a long harvest period. The importance of taste, shelf life and yield differs. Direct marketers must deliver fresh strawberries with a delicious succulent taste on a daily basis. In return they are prepared to accept higher production costs, and a possibly softer kind of fruit. In commercial marketing low production costs and a long shelf life are of upmost importance. This very often leads to a lower quality of fruit, both in taste and appearance.

In addition to direct marketing e.g. trading stands, there are also other interesting forms of marketing. Sometimes a compromise maybe involved, but results in more flexibility.
There are so many varieties to choose from, for early to late season, succelent to not so succelent and from high-yielding to low-yielding, one to meet everybody`s taste and requirements.

Direct Marketing 100%		Commercial Marketing 50%		100%
LAMBADA	FLAIR	SÉRAPHINE	RUMBA	ALBA
KORONA	GLORIELLE	ALLEGRO	ELSANTA	APRICA
JENKKA	TWIST	CLERY	PARLANDO	ELEGANCE
POLKA	DAHLI	RENDEZVOUS	AYLIN	
	HONEOYE	MALLING CENTENARY®	CADENZA	
	ROSARIA	SONATA	MAGNUS	
	ASIA	SONSATION		
	SALSA	FALCO		
	FLORENCE	FAITH		
	MARIEKA	VERDI		
	MALWINA			

Choice of Location

When choosing a suitable location for planting strawberries, various criteria must be taken into consideration. While soil values (pH values, nutrients etc.) are of importance, one should not forget to examine carefully what previous crops have been grown there, these aspects are critical in order to ensure a successful cultivation. When planning pick-your-own fields, the traffic situation and safe parking possibilities are also of importance.

Composition/Condition of Soil

Strawberries can grow almost anywhere. However, they do place a high demand on the structure of the soil. A good clean enviroment and irrigation balance are very favourable conditions for this kind of cultivation. In order for the plants to thrive the soil should not be too heavy. Stagnant moistured soil is not suitable for the growth of strawberries, this kind of soil leads to diseased cultivation as well as yield losses. The pH value should be slightly acidic, as nutrients such as iron and manganese are poorly absorbed when pH values are too high. A physiologic acidic fertilization is recommended in such cases.

Clay and sandy soils with a high humus content offer the best kind of locations for the early planting of strawberries, but only few plants rooted in this soil layer will develope well enough for planting. Therefore it is very important that irrigation is carried out even after short dry spells.

Soil with a high clay content warms up very slowly and therefore is not suitable for early cultivation, but is just right for late cultivation and can be used as a method of delaying the harvest.

It muss be also possible for heavy machinery (e.g. field sprayer).

Location of Planting Field

Open, unprotected rough areas should be avoided due to winter frost. Altitudes up to 1,400 m are no problem for most varieties. On slopes, care should be taken to avoid cold lakes as they can become flower frost hazards.

When choosing locations close to forest areas it is important that all plots, or areas should be fenced in order to prevent damage being done by wandering game (deer etc.).

Plant Health and Pre-cultivation

Successful strawberry cultivation can only work with healthy plants. In order to achieve this the soil must be as free as possible from all kinds of pathogens/disease causing agents and pests. If radical changes should take place to chosen fields, the potential area such be examined for infestation which can be caused by worms, fungi and nematodes etc. In the event of infestation, long cultivation pauses are necessary. Pathogens usually accumulate during the pre-cultivation period, and fungi, which has an extensive spectrum is very diffecult to get under control as all effective agents are not permitted by law.

Meadows and fields that have been newly sown with grass vegetation, wheat, grain or corn the previous year are particulary suitable for pre-cultivation. A no-go are areas that have been planted with natural vegetation due to weeds and worms etc. Such fields are unsuitable for strawberry cultivation.

After two consecutive strawberry harvests the soil should be given a break of at least 3 to 4 years to recuperate. Should the soil be contaminated with pink rot a break of at least 15 years will be needed.

In case of nematode infestation the intercropping of marigolds can greatly reduce the infestation. The pre-culture area should be cleared 4 – 6 weeks before planting takes place in order to allow enough time for proper soil preparation.

Host plants/carriers of Verticillium that should be avoided during the pre-culture period.

These include the following:
Plants and grasses belonging to the Papilionaceae family.
(Clover grass, lucerne and beans)
Cucumber
Celery
Potatoes
Tomatoes
Wild camomile
Ragwort (weeds)
Vines
Shrubberies
Pome and stone fruit
Cabbage plants
(Kale, Rapes and Radish)

Host plants/carriers of Phytophthora fungus that shoud be avoided during the pre-culture season include the following:
Pansies
Corn
Strong winds and airports
(ragwort, weeds etc.)
Shrubberies
Pome and stone fruit
Phacelia

Summary:

Composition of Soil:
The physical conditions of the soil are one of the most important criteria
- Loose structure (irrigation and enviromental balance)
- Main dimention of the roots lie in the upper 20 cm of the soil
- Formation of roots from 80 – 100cm (for a more balanced nutrient supply)
- Prevention of soil compaction (leads to a poor harvest)
- A well balanced soil irrigation (can cause diseases such as pink rot)

Suitable Location:
- Avoid rough open areas
- Sufficent wind movement is favourable in order to prevent botrytis
- Traffic suitation when it comes to self-picking fields.

Plant health/Pre-cultivation
- Analysing of soil for nematodes and verticillium.
- A review of all pre-cultivation.

Verticillium Studies

Problems caused to plants by verticillium have increased in recent years. This is due to both cultivation sensitivity of the certain kinds of strawberries, and that the recommended required pauses between the yields are observed less frequently. Additionally there are a number of host plants that are known to contaminate the soil during the pre-culture period. These are known to include potatoes, rapes and even strawberries themselves.
The usage of chemicals to fight soil contamination in Germany is against the law, therefore in order to combat this problem it is important to make sure that all plants are healthy and that the selected areas are not contaminated in any way.
When buying stock, it is a good idea to have more than one reliable source. It is also highly recommended to analyse the soil, as laboratory tests clearly show the degree of contamination by the number of microsclerotia per gram of soil.
Levels up to < 0,4 are regarded as contamination free, levels up to 1,0 as low contamination, levels up to 5,0 as average contamination, and any levels above these as heavily contaminated.

These results are important when it comes to selecting the correct strawberry variety for the most suitable soil.

Highly sensitive	Honeoye, Elsanta
Prone	Sonata, Elegance
Less sensitive	Asia, Symphony
Most resistant	Allegro, Aprica, Polka, Malwina

The accuracy of the test results also depend on you. The samplers must be taken in a suitable manner. (s. yellow box)

Nematodes Studies

Nematodes of the pratylenchus species can damage the strawberry plant by piercing or penetrating the root system of the fruit. This causes the plant to suffer due to the fact of a destroyed supply system.
Various fungi, which can penetrate into the plant through the injured tissue can also endanger the fruit. This results in underdeveloped growth. (Nematode infestation together with Verticillium leads to total losses in many cases.)
All surveys should be carried out during animal activity. This takes place either in autumn or between May /June. The reason for this being that all acerage should be free of vegetation. Animal movement means that the roots of the plants can be uprooted and therefore may not be includen in samples of the soil. There are very many different classifications of nematodes, which can cause various probems, so it makes sense to determine the species for sampling.

Currently known levels of harmful nematodes in strawberry crops (per 100 ml of a mixed soil sample)

Pratylenchus spp.	>	80
Xiphinema spp.	>	5
Longidorus	>	5
Ditylenchus dipsaci	>	5
Trichodorus spp.	>	160
Tylenchorhynchus spp.	>	400
Paratylenchus spp.	>	480
Helicotylenchus spp.	>	400
Rotylenchus spp.	>	400
Meloidogyne spp.	>	50

Essential soil samples

Verticillium soil samples:
- the field, or area in question should not exceed 1 acre.
- 40 incisions per acre
- an even distribution of incisions
- depth of sample to be taken: 30 cm
- use a bucket to prepare the sample
- a partical sample of 500 cubic metre will be sent to the laboratory

Result of test takes roughly up to 4 weeks, and costs approx. € 90 plus VAT per sample.
The sample can then be sent to your Department of Argiculture or a qualified laboratory of your choice to be analysed.

Here in North-Rhine-Westphalia
Landwirtschaftskammer NRW
Pflanzenschutzdienst (Diagnose)
Gartenstrasse 11
D – 50765 Köln

Further agencies:
Prof. Dr. Neubauer
Hochschule Osnabrück
Oldenburger Landstraße 24
D – 49090 Osnabrück

When speed is of the essence!
Since the taking of samples for verticillium and nematodes are very similar, one sample can be taken to give the required information by makeing 40 incision and extracting 4 litre of soil per acre. Only 500 cubic meters of soil need to be sent to the corresponding institution for the required values needed.

Nematodes soil samples

- the closer the incisions are to each other (min 30 per acre) the more acurate the sample and therfore the results.
- even distribution of incisions of the area to be surveyed.
- depth of sample to be taken 30 cm.
- quantity of soil approx. 4 litre per acre.
- use a bucket to prepare the sample needed.
- a mixed sample of 500 cubic metre should be sent to the laboratory for tests to be carried out.
- it is also very important to specify the pre-culture.

Result of test takes roughly 1 – 2 weeks, and costs approx. € 50 to € 100 plus VAT per sample.

The sample may then be sent to your Department of Argiculture or a qualified institute of your choice to be analysed.

Landwirtschaftskammer NRW
Pflanzenschutzdienst (Diagnose)
Gartenstrasse 11
D – 50765 Köln

Landwirtschaftskammer Niedersachsen
Pflanzenschutzamt
Wunstorfer Landstraße 9
D – 30453 Hannover

LTZ Augustenberg
Ref. 33 Zoologische Diagnostik/Nematologie
Neßlerstraße 23
D – 76227 Karlsruhe

Tagetes for nematode control

If more than 80 patylenchus per 100 ml soil should be found at the location chosen to grow the strawberries, you would be advised to avoid this area, and together with a specialist decide wheather to choose another appropriate spot, or to use tagetes to combat the patylenchus.
The most suitable varieties in controlling patylenchus are tagetes patula and tagetes erecta, both belonging to the tagetes family. Seeds can be sown from May on, the plants themselves must be kept weed-free and be allowed to thrive for at least 4 months to have an effect. The tagetes is very sensitive towards herbicides and frost.
Due to the latter, it is not recommended to sow marigold before mid May. After a minimum cultivation period, the tagetes is then used as a green manure and can be applied. to the soil in autumn or spring.
Remember, it is important that you ask your consultant for advise before deciding on what kind of treatment should be undertaken.

Preparation of soil/fertilisation

The preserving of a good soil structure and a sufficient supply of nutrients for the soil are the aims to be achieved when it comes to preparation of the soil. The structure can be improved mechanically by going deep into the soil in order to loosen it.

It is important to remember that the working depth should be only a few cm below the compaction level (plough blade etc.). For well structured soil, a working depth of 10 – 15 cm is more than sufficient.
If organic substances, such as humus, manure etc. are processed, the contents of the substances must be taken into account (the addition of fresh bovine manure/cattle dung can cause an increase in chloride which can be critial for the growth of strawberry).
The application of fertilizer also provides excellent results. The cultivation of rye, mustard and marigold etc. should also be mentioned.
Fertiliziation, if possible should be allowed to frement over a lengthy period of time. On the other hand such plants as phacelia and rapes etc., that are known to carry diseases that can endanger the strawberry plant should be avoided (see pre-cultures).
The application of fertilizer should be carried out on areas to be planted approx. 6 – 8 weeks before cultivation takes place. This is to give the nutrients time to mineralise so that the plants can avail of such. If large quantities of contaminated manure, cultivation debris and straw are found among the soil, misgrowth can be expected.

Preparation of soil/fertilization

Since the nutrient requirements of a strawberry plant are usually higher than those covered by normal fertilization, it is important that extra minerals should be added to the fertilizer. These should be based on the soil analysis taken previously.
Fertilizers containing chloride are most unsuitable for strawberries. All-nutrient fertilizers with a composition of N-P-K and trace elements have proven to be most successful.
If the soil analysis should show sufficient levels of nitrogen, the applied fertilizer should have a low N content.
The fertilizer containing the needed minerals should be distributed approx. 1/3 in spring, and approx. 2/3 after the harvest. Too much N in spring leades to increased vegetative growth (foliage developement) and prevents full fruit formation. In addition it becomes more difficult for the fruit to absorb calcium. The calcium is transported exclusively by the evaporation system of the plant. If a plant should have intensive foliage, the calcium to a large extent will be absorbed by the leaves, leaving only a little calcium for the fruit itself. A sufficient supply of calcium is decisive for firmness of the fruit which in turn helps to prevent botrytis. Calcium consumption during harvesting is approx. 5 kg per acre.

In addition to calcium, potassium and magnesium are also very important nutrients in order to ensure an excellent formation of the fruit. Potassium, in particular can be easily washed out of light sandy soil!
In such cases kalimagnesia may be applied (see soil analysis for details).
Potassium consumption during harvest is 20/30 kg per acre.
Sufficient potassium ensures a high sugar and acid content.
Magnesium is very important for the taste and the glossy appearance of the fruit (s. Darselect®).
The magnesium consumption of a strawberry plant during harvesting is approx. 3 kg. per acre. If the spring should be damp and cold it may be difficult for the plant to absorb the magnesium, this problem can be solved by adding patentkali. (containing 6% of Mg)

The plants only consume a small amount of Phosphorus (5 – 6 kg per acre), and usually sufficient quantities are present in the soil. Since Phosphorus is very rarely washed out of the soil there is a high risk that can accumulate there (especially where a liquid form of fertilizer has been applied). If phosphorus levels are too high, it is recommended to use fertilizers with a low P concentration level.

The trace elements necessary for the plants to thrive (boron, manganese, copper, iron and molybdenum etc.) should be present in an all-nutrient fertilizer.

Leaf fertilization is only necessary if deficiency symptoms occur. This is possible particularly if there is a cold damp spring, as these weather conditions makes it difficult for the plant to absorbe the nutrients found in the soil. It is also a good idea in such cases to apply potassium, calcium and magnesium before harvesting in order to improve the quality of the fruit.
However, all basic nutrition needed should be supplied directly by the soil itself.

Plant-material/stock

The question of which plants to choose is determined by the question whether to plant green or frigo plants. Frigo plants come in many different varieties and sizes.

Cultivation

The planting date also plays a decisive part in deciding whether to use frigo or green plants. It also has to be taken into account when and where the location is available for planting, and of course which date suits the workflow of the company involved.

Green plants: Planting period from the end of July/beginning of August
early planting: high yields, smaller fruit, a longer ripening period
late planting: lower yield, larger fruit, a shorter ripening period

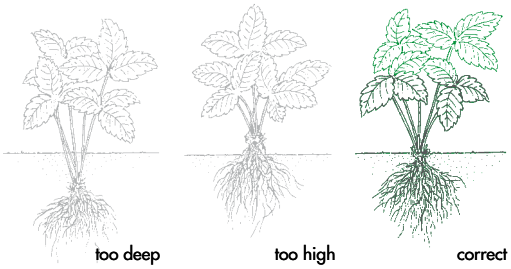
Frigo plants: Planting period from April to June
Variable planting date (April/May is recommended)
mid July can result in yield losses, losses also possible the following year
A yield is also possible in the first year approx. 8 weeks after planting (A+/A++)

Plant requirements (single-row)

Row-spacing				
	1.00m	3 plants/m	=	30.000/acre
	0.90m	3 plants/m	=	33.300/acre
	1.00m	4 plants/m	=	40.000/acre
	0.90m	4 plants/m	=	44.400/acre

– The greater the number of plants per acre, the higher the yield per acre.
– The greater the number of plants per acre, the less yield/plants per acre.

Planting depth: The right planting depth is crucial to for a successful production. The soil must be settled before planting!



planted too high:
– danger of dehydration

planted too deep:
– plants don`t thrive well enough
– when windy plants can be covered easily bei soil.
– Increased risk due to rhizoctional Infestation

Dense planting – an interesting alternative in the 60-day culture

The production of strawberries in protected cultivation is growing strongly in Germany, and since the existing tunnels used for 60-day cultivation of frigo plants may be used several times, this method of cultivation is also on the rise. A plant with a high yield potential is needed, and normally A+/A++/ Waiting bed/ Tray plants are eligible. Very often the availability of the favoured variety of plant can caus a problem. The yield potential of such plants can also fluctuate from season to season. In order to achieve successful deadline commissoned cultivation, the number of inflorescences planted per meter is decisive.
It is also quite common to match the planting distance with that of the flower mapping system.


Foto: L. Linnemannstöns

However, sometimes it has been proven that this can lead to unsatisfactory results, as not all existing inflorescences actually develope. In order to produce a satisfying yield, dense planting is a very successful alternative. Here frigo A plants are used. This type of plant produces two inflorescences more often than once. So if a sufficient quantity of this plant type is sown, a very large yield potential can be assumed. Tests have proven that planting approximately 30 plants per square meter results in very satisfactory yields. So in order to achieve this result, three A plants are planted instead of one waiting bed or tray plant. The higher price compared to that of a waiting bed plant is more than acceptable due to a higher production reliability.

Ridge/bedding planting in black foil:

This kind of cultivation method is very widespread in the Baden area, where early spring temperatures are possible. Early growth can be seen after approx. 3 – 5 days. Other techniques such as foil covering, or double covering are additionally applied in order to ensure an even earlier harvest. The blackfoil is laid together with the preparation of the bedding area, 2 – 4 weeks before planting takes place. Planting is carried out by hand.

Planting date:

The importance of the planting date for green plants in order to ensure an early harvest the following year is very often underestimated. Most orders require an early delivery date. A fast growth of the plants up to dormancy in winter is an important factor to ensure a high yield potential, however early harvesting could be considerably delayed. In order to avoid such a problem, larger numbers of plants per acre, planted later in the season guarantee an early harvest with a sufficient yield.

Loss of yield and „stunted fruit":

If the plants endure high levels of solar heat, this can lead to significant yield losses due to solar stress, and of course if night frost should also occure the number of „stunted fruit" increases

A yield loss of at least 15% under foil covering, and up to 25% under double covering can be expected.

Late frost:

An early harvest requires early inflorescence. The danger of late frost during early growth is particularly high (and expensive). In such an event, it is important that foil, fleece etc. should be at hand to enable you to react quickly in the event of sudden night frost.

Suitable varieties for early harvesting:

Open-field growth:
Alba
Allegro
Clery
Honeoye
Malling Centenary
Rumba

Tunnel:
Flair
Glorielle
Rosaria
Seraphine
Clery
Malling Centenary
Rumba

EARLY PICKING

Days 0

Normal cultivation

– 3 to – 5

Fleece

– 5 to – 7

Perforated foil

– 9 to – 13

Double covering

15 to 21

Foil tunnels

Normal cultivation

Days

0

Deep straw cultivation

+3

to

+ 14

Deep Straw

+ 13

to

+ 19

60-day culture

July

to

October

Everbearers

July

to

October

LATE PICKING

Deep straw cultivation:

Two-year-old robust plants are generally 3 – 5 days later than one-year-old green plants.

They are therefore particulary suitable for deep straw cultivation.

Plant Protection:

Both 60-day-culture and everbearing varieties need the support of a well-coordinated plant protection plan. This is particularly difficult when it comes to everbearers as harvesting takes a longer period of time to accomplish. There are a lot of different stages (flowering, maturity of fruit etc.) involved in the cultivation of the plants, and these in turn can cause difficulties when it comes to suitable protection measures.

Marketing:

The prices of strawberries have dropped drastically in recent years, and especially those of the late harvest season. It should be therefore considered in advance which particular cultivation method is most profitable for the individual farms and businesses.

Suitable varieties for late harvesting:

Late harves plants:	Florence
	Faith
	Malwina
	Sonata
60-day culture varieties:	Elsanta
	Sonsation
	Sonata
	Malling Centenary
	Flair
	Rumba
	Faith
	Elegance
	Marieka
	Malwina
Tunnel varieties:	Elsanta
	Sonata
	Sonsation
	Falco
	Malling Centenary

Open field production

„Normal cultivation" means, the cultivation of strawberry plants intended for harvesting during the varieties-specific ripening period. Planting can take place either in spring, using the frigo planting method, or in August planting green plants. To find out more about the advantages and disadvantages of these two methods please see planting. Varieties whose natural ripening period is likely to take place in the middle of the strawberry season are the most suitable for this kind of cultivation. An extension of the harvest season can be achieved by the selection of the different varieties of plants (see ripening chart).

Fleece

Fleece covering is both used to protect the plants from winter frost and early frost. Fleece of 17g are the norm, it is very rarely that fleece of 21g are used. The rate of early frost is the lower, and usually lies approx. 3 – 5 days.

Perforated foil/sheeting

Generally foils with 500 m^2 hole are applied. The premature ripening effects can be seen after 5 – 7 days depending on weather conditions.

Anti-dew foil/sheeting

Anti-dew sheeting, or foil is a kind of compromise between double covering foil and perforated sheeting. It is much easier to handle than a double foil, and results can be achieved 2 – 3 days earlier than with a normal perforated foil. Important to note is that the anti-dew coating is not UV-resisant. Therefore the foil can only be used to its full extend in the first year, afterwhich it should be only applied as a normal protecting foil.

Double covering

This is a very popular method of early harvesting. The young plants are covered with fleece (first layer), and perforated foil (top layer). The insulating layer of air which is caused between the two materials results in a premature ripening effect of approx. 15 days in comparison to that of open field production. It is important to select suitable early variety of plant, which should be planted as one year old fresh plants when possible. Winter frost protection covering with fleece can be supplemented if necessary. 17g fleece and a 500 hole perforated foil are generally used. When solar rays increase in spring, the temperature under the foil should be monitored regulary in order to avoid damage caused by heat. When flowers appear on the plants the perforated foil should be removed immediately. The fleece should also then be removed to ensure sufficent fertilisation of the plants.

Late frost can be a big risk for early flowering plants, so therefore it is important always to be able to cover the plants as quickly as possible in the event of late night frost. The additional labour involved in uncovering and covering the plants can be considerable, depending on the spring. A yield decrease of at least 20% due to stress and crippled/staunted fruit can be expected.

Greenhouse cultivation

A second cultivation of green plants takes place after a completed waiting-bed harvest in non-heated greenhouses (see harvest delay). The young plants are sown in substrate. The beginning of the harvest coincides with the time frame of the twin cultivation. For an earlier harvest, greenhouses must be heated. The advantage of a stationary house for cultivating plants and a guaranteed harvest twice a year does have its price price. Therefore it is advisable that this kind of cultivation should be accompanied by a consultant.

Foil tunnels (for an early crop)

For an early harvest fresh plants are planted on raised bed in black foil. This takes place from the beginning to the middle of August. Four plants per metre, i.e. 25 cm distance between plants, are then planted in single or double rows. For low yield varieties the distance can be reduced to 20 cm. The crops are then fertilised with a liquid fertiliser by means of a drip- irrigation hose. Site-specific fertilisation plans are required, these should be compiled together with a consultant. Plant protection procedures can also differ from those in the open countryside, and here too you should seek the advice of a consultant.

The earlier the tunnel is closed, the greater the impact of the advanced-effects on the plants. At the same time one should not forget the increased risk of losing flowered plants if a late frost does occur. Experience has shown that planting from the beginning to the middle of February has proved to be most successful. If temperatures in the tunnel should rise to 30 degrees or more during the spring months, ventilation must be provided. The ventilation procedure should take place from morning to early evening. Daily ventilation is required as soon as flowering begins. The tunnel should be closed overnight. This task should not be underestimated as approximately 130 – 150 hours are needed per acre. Ventilation also prevents botrytis.
Plants that are cultivated by using the foil tunnel method are much more advanced then those planted in the open countryside, but this also make them more vulnerable to late frost in comparison to their counterparts.

In cool weather conditions, the tunnel plants are covered with one or two layers of fleece depending on how severe the weather becomes. The pollination of the blossoms is guaranteed by the different bee colonies such as the bumble bee.
The just reward for all this hard effort is a strawberry harvest that starts 15 – 21 days earlier. Beginning usually the end of April to mid May, depending on the region. The yield itself, is 10 – 20% greater than that of an open field yield, and not forgetting the fruit quality is excellent regardless of weather conditions.
The tunnel system can be used for a second, late harvest (see late harvesting).

Cultivation in mini tunnels

Mini tunnels are well-known from asparagus cultivation, and can also be partly used in strawberry cultivation. However the premature effect that they can produce is not comparable with that of a foil tunnel. Then again investment costs such as labour costs for mounting and dismounting the ventilation system etc. are considerably lower.

The effect these mini tunnels generate lies somewhere between that of the double foil/ cover and the foil tunnel.

Cultivation in double foil tunnels

The cushion of air formed between the two sheets of foil provides additional insulation, and therefore more warmth in the tunnel.
Nevertheless, the cultivation process does not differ to that of the simple foil tunnel.

Deep straw cultivation

Locations and sites where harvesting is carried out later in the year, the deep straw method can be used to delay the harvest by an extra 5 – 7 days. When coming up to the winter months the plants must be completely covered with approx. 60 – 70 bales of straw per acre. A pleasant side effect is that this method also acts as the perfect winter frost protection system. The thick blanket of straw prevents the soil warming up to solar radiation in spring. Therefore the budding of the plants is delayed. The beginning of the harvest is very much influenced by weather conditions during this period. A sufficient supply of nitrogen must be ensured before covering takes place, as the straw binds large sums of nitrogen during decomposition.
Only strong, two-year-old, late variety plants (e.g. Faith, Malwina, Florence and Symphony) should be selected. It is very important that the plants are completely covered in time, before budding starts. In general you can expect a yield loss of between 15 – 25%. A very high fouling and fungus is quite common in very wet winter weather conditions.

60-day cultivation

Strong, healthy strawberry frigo(A+) plants or waiting bed plants are most suitable for 60-day cultivation. The plants have already blossomed during the previous autumn, they have then been picked and cleared in order to be frozen during the hibernation period. The number of inflorescences found in the rhizome determines the potential yield of the each plant.
Harvesting depends on weather conditions, but it is possible to begin approx. 10 weeks after planting has been completed. Planting takes place in single batches (e.g. every 14 days), this is to insure a longer harvest period.
The later the plants are planted, the smaller the expected yield. This is due to the fact that the plants consume a lot more reserve substances during their stay in cold storage.
This kind of cultivation should take place on raised beds, using a drip irrigation system for a sufficent water supply, this also ensures excellent root formation. Not all varieties of plants are suitable for 60-day cultivation, but currently the most common varieties are Elsanta, Sonsation, Malling Centenary, Rumba and increasingly popular Faith.
The ability to be able to offer fruits of one variety over a long period of time, makes this kind of cultivation very interesting.

Everbearing varieties

One of the requirements in order to have a good cultivation of everbearing strawberry is the planting on raised beds or in a substrate. The water- and nutrients supply has to take place via a drip hose or "Spaghetti". Plugplants are planted in September, frigo plants in March or April. In order to use the tunnels or green houses multiple times, increasingly often everbearing strawberries are planted as a connecting culture after 60-days-culture. A cultivation under rain caps is also possible. Within the last years, the cultivation of everbearer varieties concentrated more and more on table top systems.

The diverse opportunities are presented to you in a diagram on page 28.

The distance between the plants in field cultivation depends on the variety but should be between 25/33 cm. After planting on a field (frigo) the vegetative growth is most important. Covering the plants to save them from frost can make sense at the beginning of the vegetation. The first blossoms will be removed in order to give the plant a chance to grow side crowns. Harvest starts mid-July and goes on until October. The expectable total yield spreads over a long period of time. The harvest per picking is not very high, the picking costs correspondingly high.

Also, throughout the whole harvesting time ill and rotten fruits have to consequently be removed so that they don't infect the following fruits. Throughout the harvest plant protection problems will occur depending on the weather conditions. Those can lead to revenues.

The yield is much higher than from waiting tray cultures. There are no big differences in the flavor between the varieties! When cultivating in substrate, tray- or mini tray plants are the types of plants you should choose. Potted green plants can also be planted in August or September. In shelf system cultures, about 6 plants will be planted per linear metre.

Foil tunnel (late crop)

A foil tunnel or greenhouse offers the possibility to plant a late, second batch of strawberries after an early harvest has been completed. For this purpose (A+) plants or waiting bed plants are set in July. The first harvest takes place between September and October, while the second harvest follows in spring. The later the autumn harvest is completed, the less time the plants have to develope new buds, and as a result there will be a lesser yield the following spring. On the other hand, the tunnel can be used twice during the season. The plants are planted 25 cm apart in single or double rows.

Irrigation system

In order to guarantee successful strawberry cultivation, a reliable, safe water supply is of utmost importance. The various planting locations have their very own soil conditions, and this should be thought about very carefully when considering thermal irrigation. In recent years farmland regions have been plagued with long dry periods, and on the other hand, short periods of very heavy rainfall. Apart from protected cultivation (tunnels and greenhouses), the strawberry farmer is quite helpless against such weather conditions. In dry conditions a controlled irrigation system can ensure a significantly higher yield. The fruit is much larger and the plants themselves are healthier (e.g less mildew).

There are many different types of irrigation systems that can be installed, location and individual preference are usually the decisive factors. However, it is advisable to inspect the main water supply source first, after all not every grad of water is suitable for each irrigation system.

Drip lines

A drip irrigation is placed at the roots of the plants, this is carried out directly during planting with the help of a special device that is attached to the planting machine. The great advantages of these drip irrigation are, they have a low water consumption (no evaporation), they are easily manageable and can be potentialy used for fertilization. However, there are also some disadvantages involved. Leaks may occur due to damage caused by mechanical machines or even wild animals. Removal of the drip lines after cultivation can be costly. Water discharge must be iron-reduced and filtered to avoid the blockage and clogging of the fine outlet poures of the hose system.

Irrigation with sprinklers

The irrigator system is installed after planting has taken place. Pipes are placed along the strawberry fields. Circular sprinklers are mounted onto the pipes at regular intervals to ensure an almost complete irrigation of the area. Once installed, maintenance only consists of opening and closing the on-off valves. The advantage of this overhead irrigation system is the simultaneous cooling of the plants, and that antifreeze irrigation is also possible to prevent flower-frost. Disadvantages include high water consumption (evaporation), and the humid microclimatic enviroment in which the plants live (water stains on the fruit, fungi etc.).

Reel of pipe with irrigator

This system is also nick-named among strawberry farmers „the fire brigade". A water supply hose, with a large sprinkler at one end is rolled from a drum. During use the hose is automatically rolled back onto the drum, pulling the rain gun behind. The advantage of this particular method is its high versatility. The sprinkler can be moved from one location to another swiftly and without much effort. The main operation itself is rather labour-intensive, as every time the method is reactivated the drum has to be relocated and the hose needs to be rolled out anew each time. Water losses due to evaporation are of the most significant using this method than that of all other systems.

Winter frost

The frost resistance of strawberry plants is largely variety-dependent. While none or only minor damage occurs to plants covered by snow, frost alone, can lead to severe damage. Frost and wind together are an extremely hazardous combination which can lead to the drying out of the plants (frost drought).

Safety precautions

- sensitive varieties (Elsanta, Lambada) should be covered with fleece or straw (approx. 60 – 70 round bales per acre)
- if plant growth is not wished to be delayed, the straw should be removed from the rows of plants in due time before spring arrives.
- this kind of system is paticulary prone to late frost.

Spring frost

If only the first inflorescence should freeze due to frost in May, resulting damage can be minimised. The reason for this being that the second inflorescence can be provided with nourishment more effectively. However, if the second buds should be affected by frost, a large yield loss can be expected. An occurrence of late frost results in damaged and crippled fruit (e.g. Elsanta). Particularly vulnerable are early flowering varieties, and varieties which bud above foliage (e.g. Darselect® and Daroyal).

Safety precautions

- selecting areas to be cultivated (no hollow valleys with cold reservoirs, or areas where wild animals run free etc, choose protected areas)
- antifreeze irrigation
- straw should be introduced as late as possible, the straw insulates the soil, and therefore the accumulation and overnight release of daytime thermal health is lost.

Straw

The introduction of straw amoung the rows of plants, and, if possible under the plants themselves, is an important procedure due to the following reasons:

- the strawberries are kept clean, but most importantly they are protected from botrytis and colletotrichum.
- the soil moistness remains balanced, and the location is accessible even during periods of heavy rain.
- prevention of weeds
- protection against evaporation in dry weather conditions.

The best time of the year to introduce straw is the middle of May, after the „Eisheiligen" (specific date in the German agricultural calendar approx. 11 – 15 May) Any earlier is not reommended as the straw prevents thermal heating of the soil during the cold nights. This increases the risk of damage caused to the infloresence by frost.

Approximately 30 – 32 round bales of straw are need per acre. Straw can also be used as a frost protection in winter, and for delayed harvesting (see section frost protection/early and late harvesting methods).

Over the last years, the number of varieties as well as the different possible ways of cultivation have continually increased. Different types of plants are needed for the individual production methods. It is not easy to have all the desired types of plants available. In order to guarantee that you get the best type of plant for your production method, you should inform us about your plans early enough. The following order dates enable us to match our production to your demand of plants.

Order dates:

- Strawberry Frigo Plants
  October – January
  → Delivery as of January
- Waiting Bed Plants:
  Until Mai 30th
  → Delivery in the following year
- Tray Plants:
  Until Mai 15th
  → Delivery in the following year
- Fresh Plants:
  Until May 30th
  → Delivery in July/August
- Potted fresh Plants:
  Until Mai 30th
  → for delivery in July/August

Frigo plant delivery/storage:

- We deliver cold-stored (frigo) strawberry plants in wooden boxes with an inner foil bag.
- Variety name, grade, field number, etc. are recorded on a label attached to the box. If this label is missing, there is an additional label showing the variety name in the box.
- Check the shipment for damage or other anomalies and ensure that you **record this on the delivery note**.

If you are not able to plant the plants directly, we recommend storing them as follows:

- Leave the plants in their bags and boxes.
- The plants do not need any additional watering.
- Storage temperature:
- If the plants have not yet thawed: -2 °C
- If the plants have thawed +2 – 4 °C
- If stored at temperatures above freezing, the plants will start to pro duce shoots after approx. 1–2 weeks. This varies widely depending on the environment.
- **It is essential that the plants are checked daily**.

On delivery/collection of plants:

– Check that the shipment is complete (number of boxes, pallets, etc.)
– Check the shipment for damage or other anomalies and ensure that you record this on the delivery note!

E.g.: - "Conditional acceptance only due to damage to boxes."
- "Conditional acceptance only due to late delivery."
- "There are 2 boxes missing", etc.

It is essential that this is recorded on the delivery note to enable us to subsequently claim compensation for losses from the haulier. Please also contact us without delay and send us the relevant delivery note.

We deliver cold-stored (frigo) strawberry plants in wooden boxes with an inner foil bag.

Fresh plant delivery/storage:

– We deliver fresh strawberry plants in wooden boxes with an inner foil bag.
– Check the shipment for damage or other anomalies and ensure that **you record this on the delivery Note**.

If you are not able to plant the plants directly, we recommend storing them as follows:

– Leave the plants in their bags and boxes.
– The plants do not need any wetting.
– Storage temperature: 4 – 6 °C
– **You must check the plants daily!**

Potted fresh plant delivery/storage:

– We supply potted fresh strawberry plants in polystyrene or plastic returnable trays.
– Check the shipment for damage or other anomalies and ensure that you record this on the delivery note.

If you are not able to plant the plants directly, we recommend storing them as follows:

– Can be stored in a cold store at 6 – 8 °C for approx. 2–5 days.
– Check daily.
– If the leaves are wilting or early signs of grey mould are visible, the plants must be moved outdoors (in their trays).
– The plants may need to be sprinkler irrigated.

Delivery of the Plants

Our reliable logistics sector guarantees a fast delivery of the plants to your place. The desired delivery date should be coordinated with us one week in advance.

The delivery will then be executed with reasonable delivery costs. For moderate extra costs, we can also deliver the plants with special refrigerated trucks. Of course it is always an option for you to pick up your plants yourself a shortterm appointment coordination will help to avoid unnecessary waiting time. Pick-up times are Monday to Friday with prior arrangement.

Stock purchased!
Are all healthy?

Ever increasing production costs in expensive substrate cultivation, together with the respective costly plant do not allow or forgive mistakes.
It is therefore only natural that as a fruit grower, you have a huge interest in proving that your product is healthy. In order to ensure this, more and more laboratories are offering multiscreen tests.
The samples to be analysed are tested by means of PCR tests. After testing has be carried out on the sample for several pathogens (disease-causing agents), the results are more or less handed out without comment. This often leads to great uncertainty.

The following aspects must be taken into account during every stage of the different tests to be carried out.
– how should the sample be taken?
– what are the risks of contamination etc.?
– how many plants should be tested to obtain a reliable result?
– how should results be evaluated?

Test methods are very highly sensitive. Even the smallest traces of DNA can show signs of eczemas. Traces of DNA from decomposed organic cells can be detected just as clearly as possible impurities in the sample. A target-oriented evaluation of the specific problem pathogens coordinated together with an expert can be much more pratical.

Essentially, it is very understandable in order to safegard yourself by examining the material to be planted. Such examinations can give an early indication of possible problems which might occur until final evaluation has been carried out.
However, the correct interpretation of the test results is very important. Not every positive outcome means serious problems can be expected, and not every negative result means entirely infestation free.
Regarding this issue, we would like to draw your attention to the required soil tests which we have outlined on pages 46/47.

Diseases

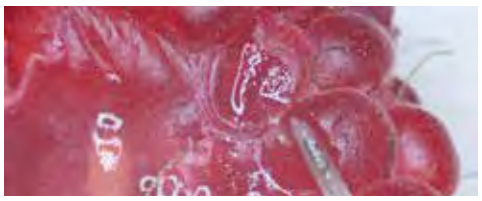
The following pages will give you a brief overview on the most important strawberry diseases. We have limited our survey and have just listed symptoms, pathogens and preventions. A more detailed version on the individual symptoms and their treatment would go well beyond the limits of this brochure. Your cultivation expert is well informed about all current approval procedures and application requirments.

According to our experience the following issues should be taken into consideration at all costs:
– protection of plants against phytophthora cactorum (dipping, spraying and autumn treatment).
– a spray program against mites to protect long-term ever bearing plants.
– resistance problems in controling botrytis.
– resistance problems in controling mildew.
– adaptation of herbicide techniques on planted varieties.

We would once again like to emphasise the fact that an extensive cultivation consultation is essential.


Xanthomonas fragariae

Sunburn

Drosophila suzukii

Symptoms:
- transparent when held against the light, especially on the reverse side of the leaf angular watery spots can be seen.
- on the reverse side of the leaf a yellowish baterial slime appears (highly infectious), and at a later stage black sport will appear on the upper side of the leaf, eventually the leaves will perish and die.
- sepals, inflorescence and shoots are also contaminated.

Symptoms
- large areas covered with brownish blistery like water spots.

Symptoms
- egg deposit even on hardy healthy fruit.
- with the help of a magnifying glass white respiratory traits can be recognized.
- developement of larvae on the fruit.
- rapid decay and fouling of fruit.

Pathogen/bacterial agents
- bacteria that can survive on dead plant matter for up to two years.
- temperatures above 20° and high humidity levels are the ideal conditions for bacteriosis.
- warm water treatment of young plants helps spread the virus.

Cause
- fruit is exposed to direct sunlight

Parasites/pests
- small fly, closely resembles the domestic fruit fly.
- male species with characteristic spots on their wings.
- due to a special egg depositing device, healthy fruit can also be infested.
- high reproductive potential

Prevention
- only plant healthy plants
- appropriate hygiene procedures must be carried out especially when working in endangered areas.
- spraying of copper

Prevention
- plant towards a north-south direction.
- regular irrigation
- varieties such as Darselect® and Florence are particulary endangered.
- hail protection net work

Prevention
- hygienic precautions, all rotten or infested fruit muss be consistently removed from the site, all fallen fruit must also be cleared.
- netting to be placed over the plants.
- laying of traps (no longer recommended in North Rhine Westphalia).
- use of insecticide in open fields from the start of egg depositing.

Anthonomus rubi

Thrips
(Thrips spp., Frankliniella spp.)

Otiorhychus sulcatus

Symptoms

- during flowering you will find snapped-off buds, which will dry and shrivel up, and will eventually fall off.

Symptoms

- shortly before fully ripening, more and more crippled yellowish golden-brown fruit falls off the plant.
- the fruit remains hard and does not ripen any further.
- insects are identifiable in the actual blossom of the plant as small worms swimming at the bottom of the flower.

Symptoms

- traces of half circular shaped bite marks on the leaves.
- withering like symptoms of plants during dry weather conditions.
- infested plants can easily be pulled out of the soil, and white beetle larvae can be found in root and rhizome area.
- the plant is destroyed by the larvae eating away at the rhizome and roots.

Parasites/pests

- a blackish brown beetle, approx. 2,0 – 3,50 mm in length (see photo above).
- the beetle hibernates under leaves or straw that cover the strawberry plants. It is also possible they they fly from one field to another.
- Immigration risk is particularly high in forest areas.
- the females lay their eggs in the buds of the strawberry plants, and can destroy up to 30 flower buds.

Parasites/pests

- insects coming from the surrounding fields, especially from fields where wheat crops have been growing.
- late cultivation plants such as Malwina, which are used for grown to order or ever bearing cultivation are highly at risk.

Parasites/pests

- black beetle, 7.5 – 9.5 mm in length
- yellowish white larvae with a brown head, approx 12 mm long.

Prevention

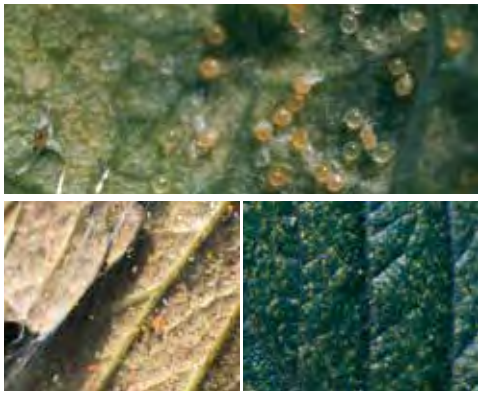
- in the event of low infestation, a reduction in the number of inflorescences still ensures a large-sized fruit.
- only rich flowering varieties should be cultivated in areas close to forests.
- the cultivation of varieties with few inflorescences e.g. Lambada, Darselect® etc., is not recommended.

Prevention

- constant monitoring of the flowers, and early treatment of thrips before influx occurs.
- please take a look at our pamphlet „Thrips" for current information on treatment.

Prevention

- avoid three-year cultivation (three consecutive years).
- raspberries should not be cultivated in infested areas.
- combat by using nematodes



Red spider mite
(Tetranychus urticae)

Strawberry mites
(Transonemus pallidus)

Cockchafer
(Melolontha melolontha)

Symptoms

- light square shaped spots on the upper leaf.
- in the case of infestation, large numbers of transparent eggs on reverse side of the leaf.
- in the event of severe infestation, the various stages of development from the egg to the mite are clearly visible in delicate fine webs on the reverse side of the leaves.

Symptoms

- newly sprouted heart-shaped leaves appear to be very much creased and curled up.
- infestation can be easily mistaken for virus diseases or leaf and threadworm.
- early attacks infestation of individual plants, which then spread nest-like.

Symptoms

- cockchafers eating away at the roots causes major damage, signs of wilting and in an extreme case the plant dies.
- large damage can also be caused by crows searching for larvae, plants can dug out on a large scale by birds.

Parasites/pests

- the insects are between 0.3 and 0.5 mm in length, are yellow in colour, and have two black spots one on each side of the body.
- the female spends the winter months hibernating on the plants (orangery-red female).
- the coloney then expands in spring when temperatures rise (6 – 8 generations).
- transition from egg to adult takes three to four weeks. Warm and dry weather conditions are perfect conditions for development.

Parasites/pests

- these mites are almost impossible to spot with the naked eye (0.2mm in length).
- if between July and September young plants are suspected of having been infested remove all curled leaves and check carefully for disease.
- mites spend the hibernation period in the heart of the plants, and lay their eggs in the unfolded young leaves.
- developement phase from egg to mite is approx. 2 – 3 weeks.

Parasites/pests

- may beetle 25 – 30 mm in length.
- cockchafer lava approx. 45 mm long, white to a dirty white in colour and can be found in the soil close to the roots of the plant.
- most damage occurs in the two years after the first flight

Prevention

- plants for early harvesting that will spend the winter under foil should be insect free before doing so.
- restrain amount of nitrogen fertilization in spring.
- the use of pretatory mites against pirate bugs especially in greenhouses is known to achieve positive results.

Prevention

- young plants and seedlings must be completely free of all soft-skin mites.
- best treatment period, for August to September.

Prevention

- no rich natural grasslands should be chosen for preculture (see wireworms).
- contourning the soil with milling machines and tools will only eliminate some of the larva.
- the boarderline should be 1 – 2 larvae (20mm) per m^2.


Harmful nematodes
(Pratylenchus longidours sp.)

Symptoms
- significant growth depression
- increased vulnerability towards other soil-based fungi.
- feeding traces or total destruction of roots due to invasion (of insects).
- nematodes together with a verticillium infestation will often result in total destruction of the plants.

Parasites/pests
- wild living nematodes of the pratylenchus species.
- several nematodes species generally appear simultaneously.

Prevention
- before planting begins a nematode sample should be taken from the land.
- where levels are high a intercropping with targetes (marigold) is recommended.
- no direct treatment against nematodes exists.

Elateridae

Symptoms
- in particular after ploughing has taken place worms and their like can cause serious damage.
- the cultivation of strawberries directly after ploughing is not recommended.

Pathogens/bacterial agents
- larvae from the click beetle (Elateridae).

Prevention
- can not be controlled.
- avoid contaminated areas.

Snails/slugs
(Gastropoda)

Symptoms
- tiny holes and bite marks on ripe fruits.
- slime marks can be found.
- in seasons where wet weather conditions occur heavy losses can be reckoned with.

Pathogens/bacterial agents
- various snail varieties.

Prevention
- mowing meadows and grasslands frequently.
- the location should be chosen in such a way, that if at all possible, it should not lie adjacent to another meadow or field.

Bugs

Symptoms

- Change of color and holes in the leaves
- Fruit deformation, e.g. crippled berries with tight nutlets

Pathogens/bacterial agents

Pests: (not complete)

- Southern green stink bug
- Brown marmorated stink bug
- Green shield bug
- Alfalfa lygus
- Dotted nettle bug
- Mottled shieldbug
- Sloe bug
- Forest bug

Prevention

- No pesticides permitted
- Beneficial insects are being looked for
- Remonts are affected more
- Everbearing varieties

Grey mould

(Batrytis cinerea)

Symptoms

- first sign of infestation are brown spots which can be seen on the unripe fruit.
- the fruit becomes very soft and a kind of greyish fungus appears.
- the fungus is highly contagious, healthy fruit can be infested as a result of physical exposure.

Pathogens/bacterial agents

- a fungus that not only attacks the strawberry fruit itself, but virtually all parts of the plant that have been infested.
- hibernating on old plant remains.
- best climatic conditions for survival, high humidity and temperatures of approx. 20°.

Prevention

- prevent use of varieties that are prone.
- low levels of nitrogen fertilizers.
- early deposit of straw.
- allow plants to dry sufficiently between irrigation.

Gnomonia fruit rot

(Gnomonia fructicola)

Symptoms

- dark brown uneven spots on the leaves which eventually blend together.
- in severe cases of withering the leaves perish.
- sepals and stem become brown after inflorescences takes place.
- fungus spreads over the unripe fruit, whereas ripe fruit has a rubbery-like texture and decays quite quickly.
- infested fruit becomes a fungal film from which a yellow slime can emerge from.

Pathogens/bacterial agents

- a fungus that hibernates on parts of the plant that are located above the soil.
- infestation take place prior to flowering.

Prevention

- prevention can be accomplished by spraying the blossoms.
- after noticable signs of damage have appeared there is no chance of an effective cure.
- remove infested fruit immediatly from the harvest.

Pestalotiopsis longiseta

Symptoms

- 3 – 4 mm size deep brown spots appear on the fruit, subsequently followed by the appearance of a white fungus.
- dried and shriveled fruit.
- withering of plant very similar to that of Phythophthora cactorum.
- a brown cork-like tissue between the rhizome.

Parasites/pests

- a fungus parasite that not only can infect the rhizome of the plant, but also the strawberry fruit itself.
- frequently mistaken for phythoptora spec. or collectotrichium.
- a precice analysis is only possible if samples are sent to a laboratory for identification.

Prevention

- use only healthy plants and seedlings.
- cultivate hardy non-sensitive varieties.
- a normal standard treatment, such as that used against phytophthora is pointless.
- an additional intergrated switch treatment between August and September is highly recommended

Crown rot
(Phytophthora cactorum)

Symptoms

- brownish discolouring of leaves from the centre of the leaf outwards (not to be mistaken for verticillium, where the leaves perishes from the outside inwards).
- red brown decay to be found amoung the rhizome.
- during early stages of growth the plants appear to be healthy, it is only after developement of the disease that signs of infestation can be seen
- increased outbreak of symptons appear three to four weeks after planting, and in some cases shortly after sowing.

Pathogens/bacterial agents

- fungi (bacterial agent) that attacks the plant`s rhizome, and then disables the transport of moisture to other parts of the plant.
- the fungi occurs by means of persistent oospores (spores), the fungi penetrates the plant through little cuts and injuries on the rhizome or roots, the developing mycelium then block the water channels of the plant.
- fungus thrives best when the soil is waterlogged.

Prevention

- when relocating make sure the soil is not waterlogged.
- pre-cultivation sure be take into account (host plants).
- check nematodes (LWK tests).
- spraying of phosophoric acid as a standard procedure in autumn.
- pre-planting dip-treatment, or a spraying procedure eight days after planting.

Phytophthora cactorum

Symptoms

- brown discoloured ripe fruit.
- skin of the fruit has a leather texture.
- infested ripe fruit is milky white to pale pink in colour, and the fruit has a bitter taste.

Pathogens/bacterial agents

- see phytophthora cactorum.

Prevention

- see Phytophthora cactorum.

Macrophomina Phaseolina

Symptoms

- dying leaves, wilting
- easily confused with verticillium wilt and Phytophthora cactorum
- in hot conditions in particular (28–35 °C) can lead to high levels of plant failure

Pathogen

- Fungal pathogen from South Asia (heat-loving)
- more than 500 known host plants
- widespread in Southern Europe (Spain, Italy, etc.)
  - first observed in Germany in 2022
- survives in soil as microsclerotia
  - spread via plants and soil

Prevention

- use healthy propagating material
- remove affected plants/plant parts
- hygiene measures
- no direct treatment available

With the support of Kraege, RWTH Aachen develops a PCR-based evidence for bacl root black pathogens

Ever since the 1990s, Prof. Dr. Roland Weber and Alfred-Peter Entrup have witnessed an increasing occurrence of black root rot symptoms. This is a complex of different harmful fungi, which are responsible for infestations on strawberries or raspberries.

In order to investigate this phenomenon further, a high amount of strawberry- and raspberry roots have been examined in the laboratory of the Esteburg between 2007 and 2014. The main results of Prof. Weber and A. Entrup were that mainly Dactylonectria torresensis and Cylindricarponspecies are responsible for the symptoms of the ill roots.

Because of these realizations a PCR-based evidence for this kind of black root rot pathogen was developed at the RWTH Aachen. This project was significantly supported and financed by Kraege.

The method for this evidence was handed over to the laboratory of Ms. Dr. Heupel from the LKW NRW in Auweiler.

With this method, in the future it will be possible to examine suspicious plant material in order to see if there are harmful fungi involved.

Black root rot

Symptoms

- as the entire root system is rotten and decayed, plants can be easily extracted from the soil.
- the black crust, or bark of the root can be very easily removed from the white central cylinder.
- staunted growth.
- between blossoming and harvesting, the leaves begin to wither and eventually the plants die.
- the fruit of diseased plants remains small, in other words premature ripening and dried fruit before harvesting.
- damage caused during warm weather spells is clearly evident.

Pathogens/bacterial agents

- not just one pathogen, but a number of disease components.
- various varieties of fungi, nematodes and bacterial agents are at fault.

Prevention

- avoid land with poor soil structure densification.
- choose a multi-crop rotation system.
- improve the soil by means of adding organic substances.
- always use strong, healthy seedlings and plants.

Phytophthora fragariae

Symptoms

- poor budding and stunted growth in spring, shrivelled-up leaves in autumn.
- older leaves wither up and die.
- the main root system has no side-roots (rats tails), the red centre of the infested rhizome appears healthy.
- small amount of fruit and slow growth.

Pathogens/bacterial agents

- a soil fungus that attacks the roots of the plant, and thus prevents the intake of water.
- at least five species of fungi are known.
- infestation through disease plants, soil cultivation equipement or permanent spores can persist as long as up to 15 years.
- compressed waterlogged soil encourages infestation.
- the fungus thrives on temperatures below 10°.

Preventation

- plant healthy plants, and if possible stay away from varieties that are known to be sensitive.
- note pre-cultivation.
- contaminated areas should be avoided for at least 15 years.
- locations known to be waterlogged should also be avoided.
- spraying of phosophoric acid as a standard procedure in autumn.

Verticillium wilt

(Verticillium albo atrum, Verticillium dahliae)

Symptoms

- particularly on warm days first signs of wilting can be seen (in constrast to p. cactorum the outer leaf starts to perish first).
- in cooler weather conditions the plant may often recover, and small heart-shaped leaves keep their green hue.
- the disease appears in a „nest-like" form.
- plants are compressed and develop poorly.

Pathogens/bacterial agents

- a soil fungus with a large range of host species (see pre-cultivation).
- the fungus can survive together with microsclerotia up to 15 years in the soil.
- the damage caused affects the water channels of the rhizome.
- severe symptoms often occur in combination with nematodes

Prevention

- note all pre-cultivation, never plant strawberries after potatoe growth!
- assessment of soil before planting.
- hardy insensitive varieties.
- before planting make sure all plants and seedlings are healthy.

Anthracnose

(Colletrotrichum acutatum)

Symptoms

- young plants are slow in growth.
- large circular brown spots can be seen on unripe and ripe fruit alike (spots eventually turn black).
- contaminated fruit tissue is dry and firm
- black spots (0.5 – 1.5 mm) also to be seen on the leaves of the plant (can be mistaken for rhizoctonia).
- a white fungal spore coating can be seen where rotting occurs.
- the rhizome turns a reddish colour.

Pathogens/bacterial agents

- A fungus which can also be found among cherries, blueberries and blackcurrants.

Prevention

- use healthy plants.
- fresh plants are always more prone compared to frigo plants

Mycosphaerella fragariae

Symptoms
- small round, brownish crimson spots can be seen on the leaves (the centre turning grey to white).
- in cases of severe infestation the spots will run
- more frequently to be seen on older leaves.
- infestation mainly occurs after harvesting.

Pathogens/bacterial agents
- hibernation of the fungus on the strawberry plants.
- the infestation occurs through the pores on the surface of the leaves (stomata of the leaves).
- humid weather conditions with temperatures of above 20° are most favourable.
- several species of fungi are known.

Prevention
- stripping and trimming of leaves after harvesting
- cultivation of less vulnerable varieties.
- provide and ensure proper ventilation (sufficent gaps and spaced-out-rows ect. for the plants).

Diplocarpon earliana

Symptoms
- small uneven brown-red spots, no white centre.
- in cases of severe infestation leaves, stems and sepals will be attacked.

Pathogens/bacterial agents
- the fungus hibernates with the permanent spores on the plant. The fungus then penetrates into the plant by means of the cutical on the surface of the underside of the leaf.
- temperatures of around 20° are the perfect weather conditions for the fungus to develope.

Prevention
- stripping and trimming of leaves after harvesting.
- cultivation of less vulnerable varieties.
- provide and ensure proper ventilation (sufficent gaps and spaced-out-rows etc. for the plants).

Sphaerotheca macularis

Symptoms
- a light thin white coaring appears on the underside of the leaves, which then turn a light reddish colour and curl upwards.
- infested fruit appears to be covered with a white powder.

Pathogens/bacterial agents
- fungus that hibernates as mycelium on the leaves or with permanent spores mainly on the plants.
- thrives and spreads quickly in spring with temperatures rising above 10°.
- optimal weather conditions are temperatures of 20 – 25° and high humidity.

Prevention
- cultivation of less vunerable varieties.
- provide the necessary ventilation for the plants.
- trim the leaves of the plants after harvesting.

Beneficial organism

When cultivating in local restricted areas such as in tunnels or greenhouses, the use of beneficial insects can be quite useful. These beneficial insects cannot migrate quickly, and it is possible to establish a positive predator population.

If you choose to work with beneficial predators it is important to monitor the diverse species very closely in advance. For many pathogens warning signs can be seen (yellow/blue charts, pheromonary pitfalls) and these can help to quickly identify an infestation. Visual monitoring is also very important and should be carried out as accurately and precise as possible. The quicker a parasite is tracked down, the greater the chances of success using beneficial insects. In comparison to using chemical methods, the growth of the beneficial insect population takes time to develope. The parasite population (prey) initially has a certain advantage. As the number of parasites increase, so does that of the predator, which are now gaining the upper hand. It is an interdependent system which must be held in balance.

Parasites/pests	Benefical spicies
Aphids (plant louse/ greenfly)	Aphidius colemani Aphidius ervi Aphidius matricariae Episyrphus balteatus Lysiphlebus testaceipes Aphelinus abdominalis Aphidoletes aphidimyza Chrysoperia carnea
Spider mites (thunderfly/ thunderbugs)	Amblyseius californicus Feltiella acarisuga Phytoseiulus persimilis
Thripse	Amblyseius barkeri/ Amblyseius cucumeris

If beneficial insects are to be used, the application of plant protection substances is of course prohibited. However, if levels are critical exceeded the use of chemical agents may be the only way of saving the cultivation (crop).

On the chart opposite you can see a list of parasites where the application of the beneficial insects method is an option. A clear identification of the particular parasite in question is essential. These beneficial insects are highly specialised. It is not sufficient just to detect a aphids/louse infestation, the particular species must also be identified. This is the only way to select the best suitable beneficial insect for the particular problem.

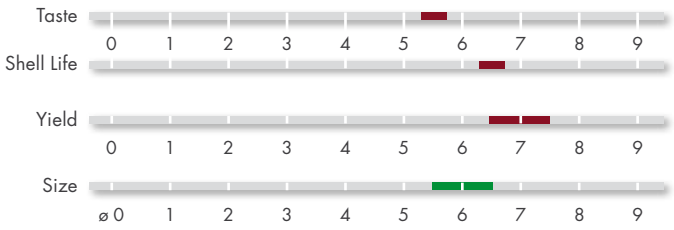
This topic is a very complex one. The constant monitoring and, if necessary the identification of the various parasites is often very complicated and time-consuming.

If you are thinking of applying this method of prevention, please seek advice from an expert.

Loch Ness

Colour: bright black, cylindrical Fruits

Comments: stingless, early, start of harvest beginning of August, very sensitive for downy Mildew

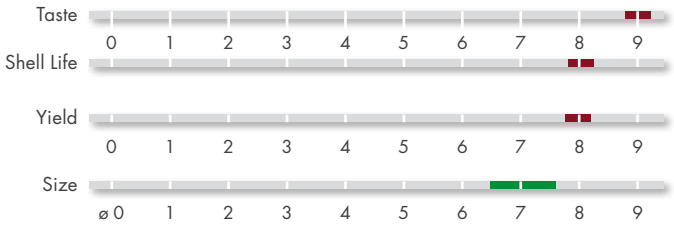


Provenance: James Hutton, GB

Loch Katrine

Colour: bright black, cylindrical Fruits

Comments: stingless, easy to grow, easy to pick, start of harvest beginning of August, high fruit quality



Provenance: James Hutton, GB

Blackberries – Long Cane Plants

There is a trend in direct marketing, to widen the offered range of berries. Besides strawberries and raspberries, interest is growing for the blackberry culture in containers.

This works, similarly to the raspberries, very good as a culture with long canes. Blackberry long canes are partially grown potted blackberries, similar to the raspberry long canes, lifted on a trellis from the producer. During hibernation, the plants will be wrapped up and frozen. From the next spring on, the long canes will be put back in a trellis to produce fruits.
5 or more canes are recommended per pot of blackberries. The desired height of the plants is about 180 cm, similar to the raspberries.
The main variety right now is Loch Ness, but other varieties are available if requested.

The plants will be replanted from the fruit producer into plant containers with about 5 liter substrate. The distance between the pots should be 0.60 meters in a row and the distance between the rows should be 3 meters.
The individual canes will be tied to a trellis.

New experiments deal with blackberry canes „pooled fixation". At a test center in Köln Auweiler they were able to show that it is possible to fixate all of the canes in one pot pooled on one Tonkin Cane. This is way less work than the time-consuming fixation of the canes to a trellis. The total yield was a little bit smaller with this form of cultivation, but the workload was decreased enormously. The size of the fruits stayed the same in both systems

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