FRUIT SECURITY

HAGELSCHUTZTECHNIK

SYSTEM WIESEL

HAIL PROTECTION VERSUS RISK

Economic advantages gained by implementing hail protection in the fruit growing business:

- ⇨ Protection of investments (trees)
- ⇨ Safeguarding the harvest

Benefits for the fruit grower

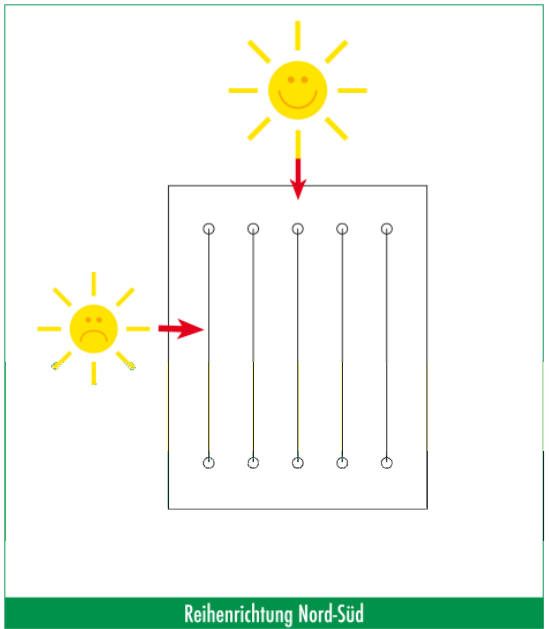
- ⇨ Avoiding permanent damage to the cultivated crop
- ⇨ Less danger of alternation through hail damage
- ⇨ Reduction of sun damage
- ⇨ A more evenly spread colour = a more uniform surface of the crop
- ⇨ Less wind on the culture = less wind damage
- ⇨ Optimised, selected crop protection is possible
- ⇨ Increased stability of the structure by means of cross bracing
- ⇨ Protection against fire blight by wood damage
- ⇨ Protection against birds
- ⇨ Protection against insects such as cockchafer and European corn borer
- ⇨ Independence from insurances

Benefits for warehouse keepers

- ⇨ Continuous level of warehouse operation
- ⇨ Reduction of the fixed costs per kilo of the stock goods
- ⇨ Continuous market supply with top-class quality
- ⇨ Safeguarding the market sales shares
- ⇨ Expansion of the market shares in hail years

Disadvantages of a hail protection device

- ⇨ Cost-intensive
- ⇨ Higher work expenditure
- ⇨ Adverse effect on light exposure



PLANNING

Please see below the facts which must be taken into consideration before hail protection is installed:

Row direction

As far as row direction is concerned, there are some important factors to be considered:

- ⇨ When situated on a slope, rows should be in the direction of fall or along the contour line.
- ⇨ Direct sunlight, creation of shade.

Row width

Depends on the respective crop and cut technology. Additionally, the required tree height and the machines in use must be taken into account.

Height of the plant

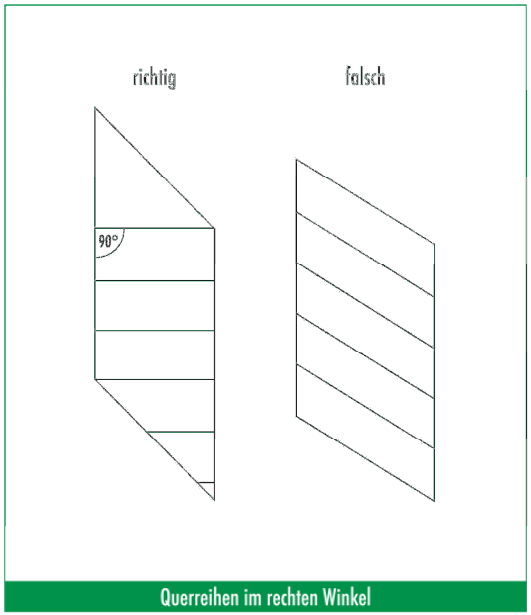
Again, the respective crop, cut technology, tree height and the machines in use must be taken into account.
The height of the plant and the height of the columns must be differentiated because the columns will be placed into the soil, reducing the effective height of the columns.

Distance from the anchorages / front turn-around area

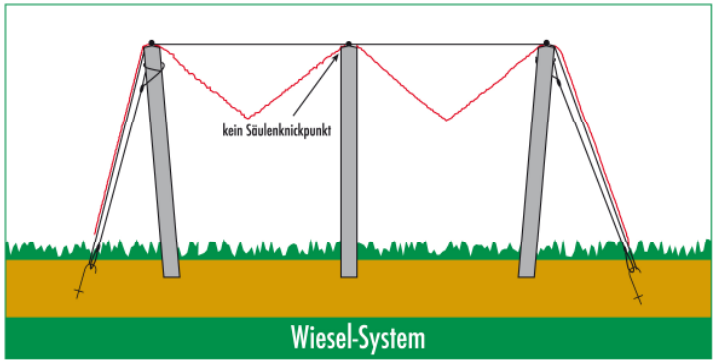
When planning, it is essential to consider the required anchorage distances. These anchorage distances depend on the height of the columns; the standard value is not less than 2 m front-faced (in alignment with course of row) and not less than 1.5 m side-faced.

Cross lines at an angle of 90° to the direction of row, or otherwise refer to the plant layout

If possible, it is basically advisable to keep to an angle of 90°.



CHOICE OF SYSTEM



After determination of the plant's basic features, the choice of system can be considered, chosen among the following basic systems:

Cross stabilisation over the net

The specific features of this system are the fibres or ropes used for cross stabilisation at the highest point of the column (ridge anchorage).
Consequent advantages:

- ⇨ Increased stabilisation of anchorage at the highest point.
- ⇨ Increased stabilisation by anchorage of length and cross stabilisation on the same spot (grid effect).
- ⇨ More room for work and more operational safety under the net.
- ⇨ Net preservation since there is no contact with fibres or ropes outside the ridge area.
- ⇨ Less scatter damage in comparison to other systems.

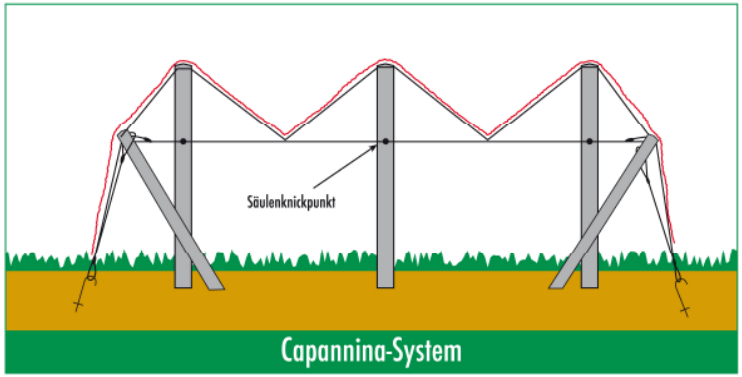
The WIESEL system can be seen as an example of cross stabilisation above the net, which was formerly known as the flat net system.

Cross stabilisation beneath the net

The specific feature of this system is that the ropes used for cross stabilisation are anchored beneath the net.
Resulting advantages are:

- ⇨ Costs about 5 % less than systems with cross stabilisation above the net.

The Capannina System is an example of cross stabilisation beneath the net.



Without cross stabilisation

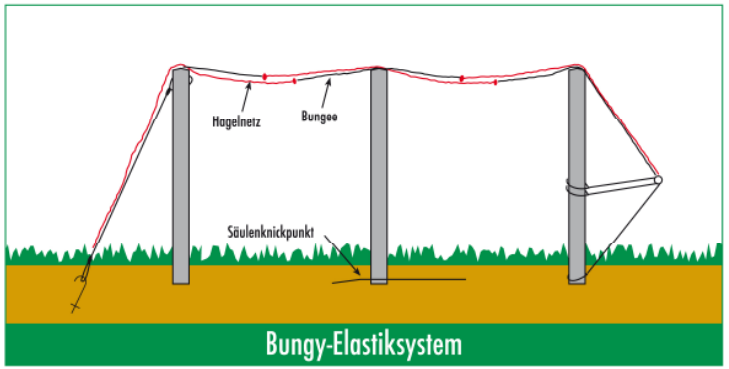
Resulting advantages are:

- ⇨ Costs about 15 % less than systems with cross stabilisation above the net

Resulting disadvantages are:

- ⇨ Great risk of net damage during thunderstorms and heavy crops.
- ⇨ Columns must be placed very deep in the soil which is not always possible.
- ⇨ Short life time

The bungy or elastic band systems which are mainly used in France or in Spain, are an example of cross stabilisation beneath the net.



Columns made from prestressed concrete

The major benefits of the columns made from prestressed concrete lies in the constant quality and longevity. Considerable differences in quality of various producers are to be regarded. However, every required length can be produced within a relative short period of time. Compared to wooden columns, the disadvantage is the increased weight and the reduced elasticity.

Columns made from wood

The major benefits of wooden columns are the low weight, the fact that the columns can easily be processed and that they are more elastic compared to the columns made from prestressed concrete. Disadvantages lie in the big differences in the quality of wood and in the standards of impregnation.

Choice of type of net and colour

The net consists of interwoven polyethylene fibres with a thickness of a Ø of 0.28 – 0.32 mm. The quality and the thickness of the fibres are decisive for the life time of the entire plant. The thread can be produced in various colours, whereas the colours black and crystal (comes across as white colour) have proven their superiority in practice; moreover, the common interweaving of both colours that optically make up a grey shade should also be mentioned. For fruit growers there is the advantage that as far as colouration of the mainly red apples is concerned, nets made of crystal fibres are more translucent. However, the other side of the picture is the considerably shorter life time due to lesser UV-stability of the fibres and the missing protection against sunburn on the fruits.
Also bear in mind the weaving of the hail nets. It is important to have small mesh size openings so that the crop is also protected against small hail stones. It is further necessary to have a compact weave so that individual threads cannot be easily disarranged, causing holes in the net. Additionally, the width of the thicker marginal or central film panels has to be considered because here hail nets can differ greatly. The thicker marginal film panels are important for the placement of the net connections and, due to this thicker marginal film panels, a net curtain may be installed. The thicker central film panel is important for both ridge wire tensioners and installation of ridge wire tensioner cap. It is not advisable to install securings outside the thicker film panels.

Choice of net connections

The connection between the net halves in the eaves is widely known as net connection. One net connection each is installed onto the hail net's seam. These two net connections can be connected via a closure system. The net connections are exclusively made from synthetic material. The criteria which net connections to choose depends on how quickly these connections can be opened and closed since this procedure must be carried out every year. Further criteria are the length of time for initial installation, opportunity to deinstall und reinstall, life time, integration of overload protection (predetermined breaking point), and of course, the price.
Another kind of securing of both net halves are bungy or elastic band systems. The connection does not take place via the net connections but between the connections there is an elastic rubber rope.

With or without net curtain

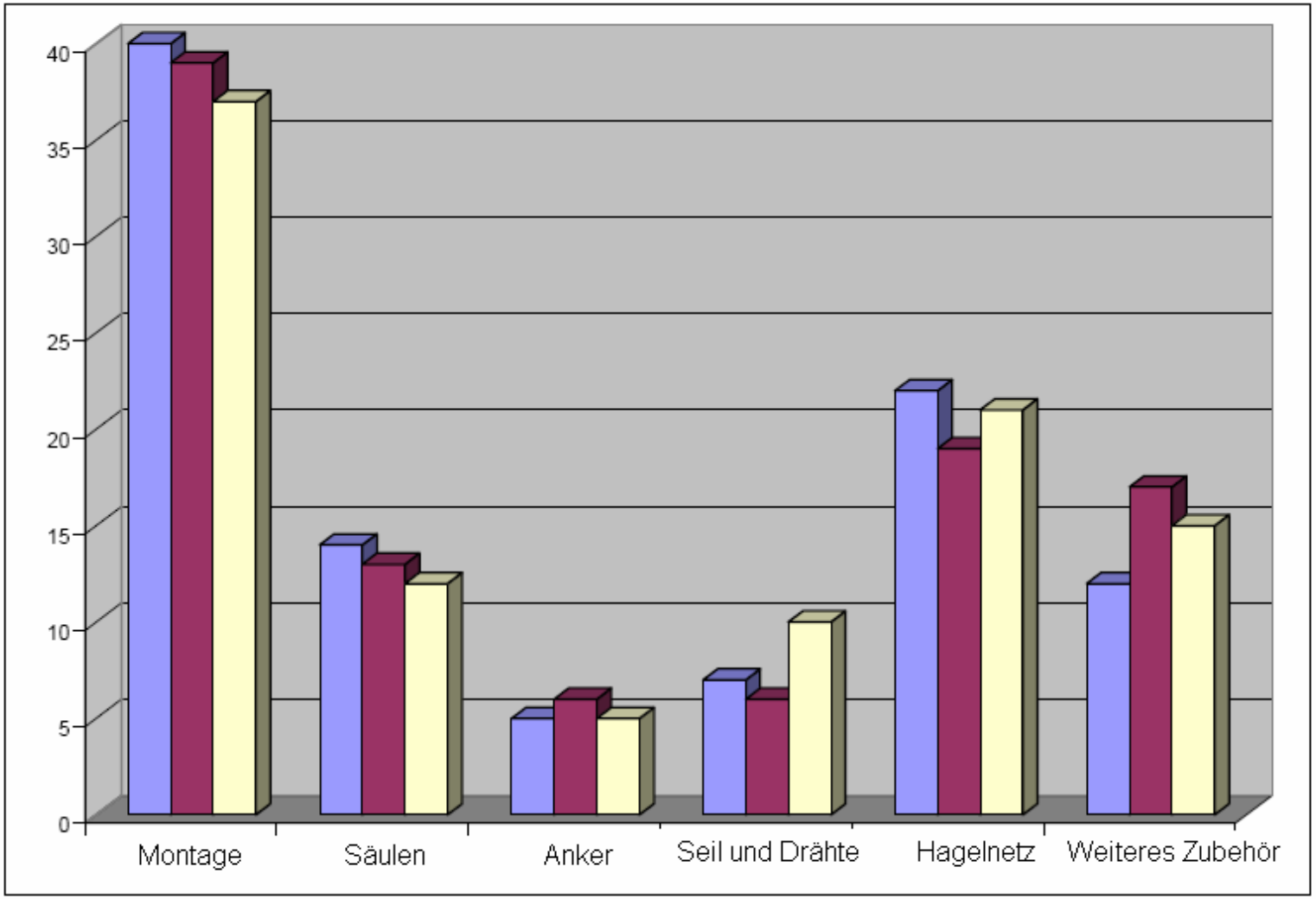
For this system it is characteristic that the net connections are not placed directly at the seam of the net but 5 – 15 cm away from the edge. Therefore, the size of the thicker nets' edges has to be increased accordingly. This net curtain will be installed despite existing hail net systems because crop damage may occur due to heavy winds or hail. This is called scatter damage. The so-called net curtain hangs in the eaves and slows the hailstones down resulting in a considerably smaller probability of hitting the crop.

Steep/flat gable

First and foremost, the advantage of a steep gable is the easier hail emptying – less risk of damage for fruit, plants and hail system; compared to the flat gable, more net structure is needed. Another advantage of a steep gable is the opportunity of the net connections' handling directly from the ground.

Comparison of costs in relation to all systems

Red = Wiesel system total costs approx. 100 % € 18,000
Blue = Capannina system total costs approx. 95 % € 17,100
Yellow = Bungy / elastic band system total costs approx. € 15,300



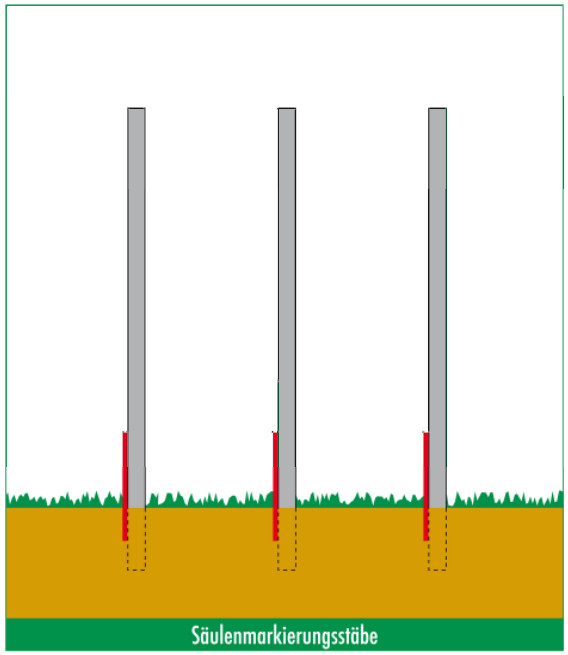
SETTING UP

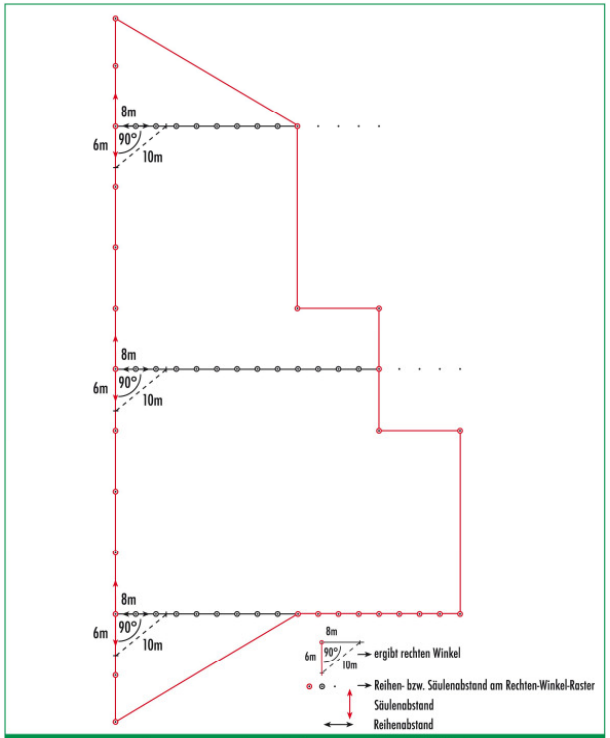
After the planning phase and the choice of system have been finished, the hail protection plant is set up; if it has not already been done, the first step is to determine the exact measures and mark the columns and the anchorage points in the plant. Only then can the next steps be taken:

1. **Pick up the measures of the plant**
2. **Erect the columns**
3. **Fix the anchoring**
4. **Fix the columns**
5. **Fix wires/ropes**
6. **Install and secure nets**
7. **Place net connections**

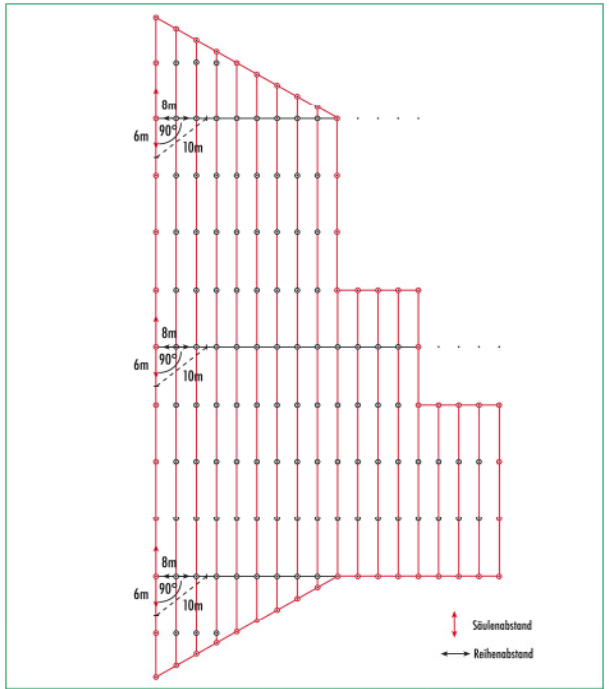
DIMENSIONING OF THE PLANT

At the longer edge row the column's distance is measured and marked. Afterwards at the first and last full-length cross row the right angle is determined and the row spacing is measured and marked on these cross rows.
In the case of longer plants, a cross line is fixed at right angles approx. every 100 m. To mark the position of the columns, the dimensioning of the plant should be done by positioning bamboo poles or the like. It is very important that all the columns are placed on the same side of the marking poles because otherwise it is not possible to get a straight line.


Säulenmarkierungsstäbe



Ausmessen einer Anlage - rechter Winkel



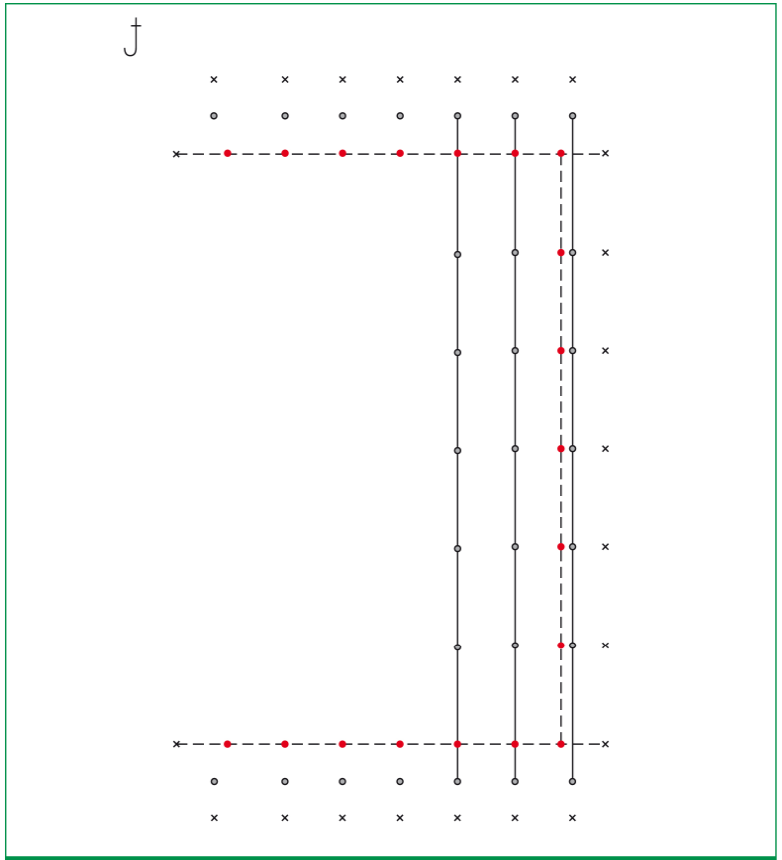
Säulenmarkierung bezugnehmend auf Reihenabstand, Säulenabstand u. rechten Winkel

ERECTING OF THE COLUMNS

After the required height of the plant and the type of columns had been selected during the planning stage, the length of the columns can now be chosen. The length of the column is the sum of the length put into the soil and the height of the plant.
Here the length put into the soil depends on soil profile and column dimension. A depth of 0.5 m can be regarded as a standard value.

Minimum column dimension for front columns and columns placed on the edge:
For concrete columns 9 x 9.5 with at least 6 x 3 wire tensioners
For wooden columns 11 - 13 cm mean diameter

Minimum column dimension for inner columns:
For concrete columns 7 x 7 with at least 4 x 3 wire tensioners
For wooden columns 9 - 11 cm mean diameter

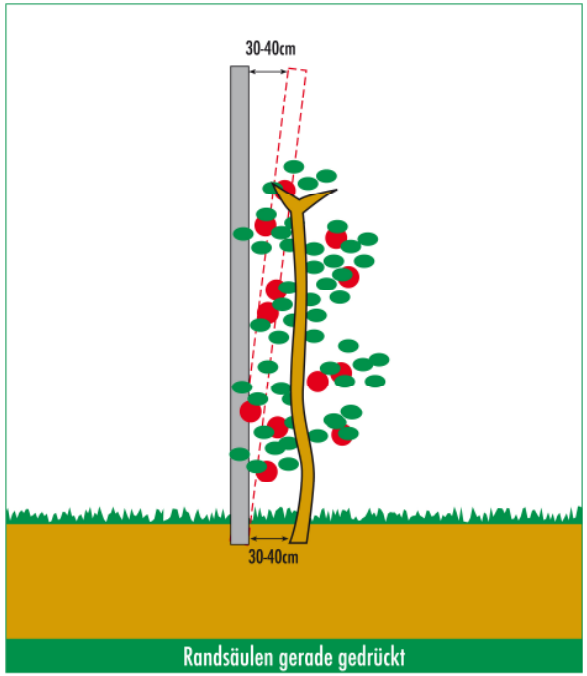


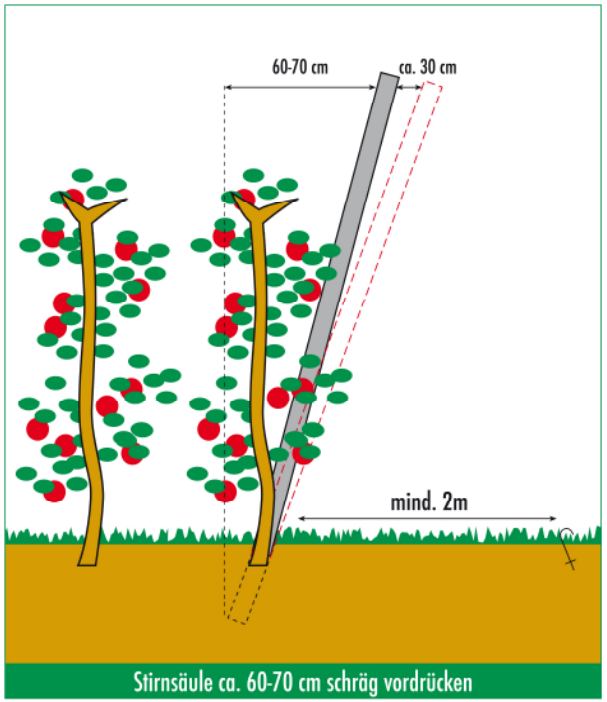
Aufstellen der Säulen

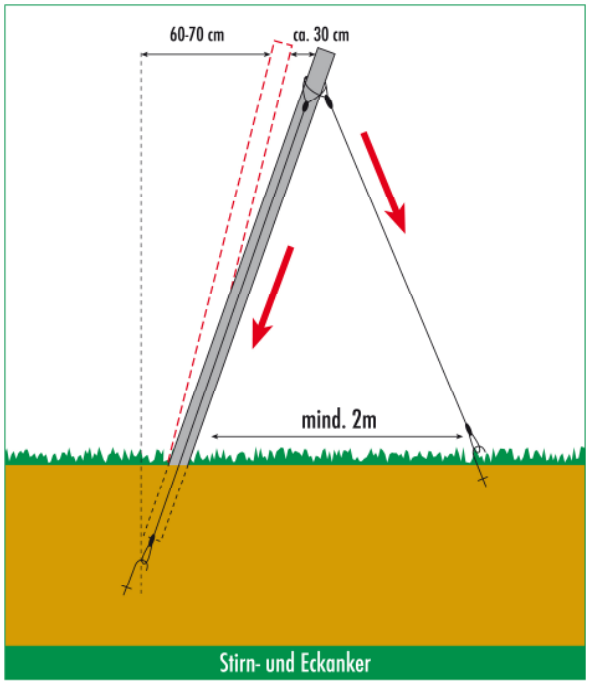
The procedure in the correct order:
Column marking of the length that is supposed to be put into the soil

- ⇨ Columns brought in the plant
- ⇨ Placement of the columns on the marked spots

The columns' placement can be done by directly pressing into the soil with a caterpillar machine or the like. If compact soil occurs, a hole must be prepressed by means of a hole tool or a hole must be dug out. When pressing with a caterpillar machine it is important to carefully look in the direction of the rows and in direction of the cross stabilisation so that the columns are aligned. Minor deviations of about 10 cm on the top of the column can be balanced out later during securing of the columns.

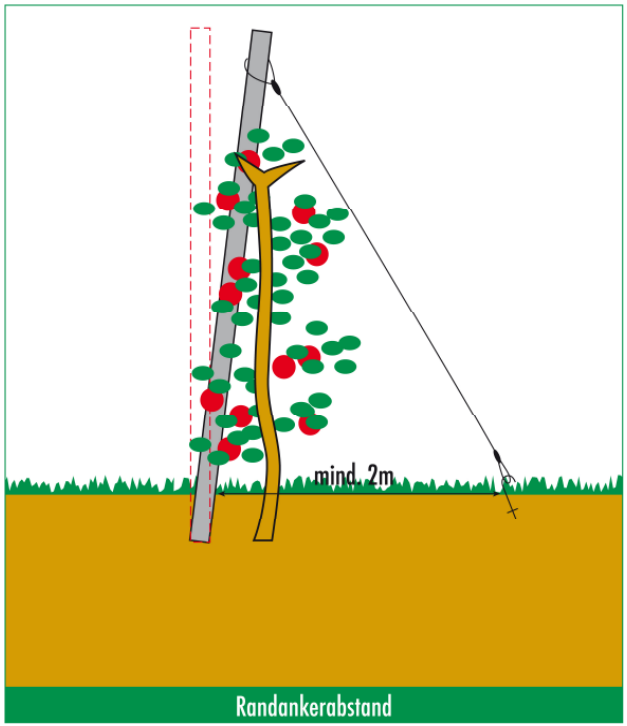






PLACING THE ANCHORAGE

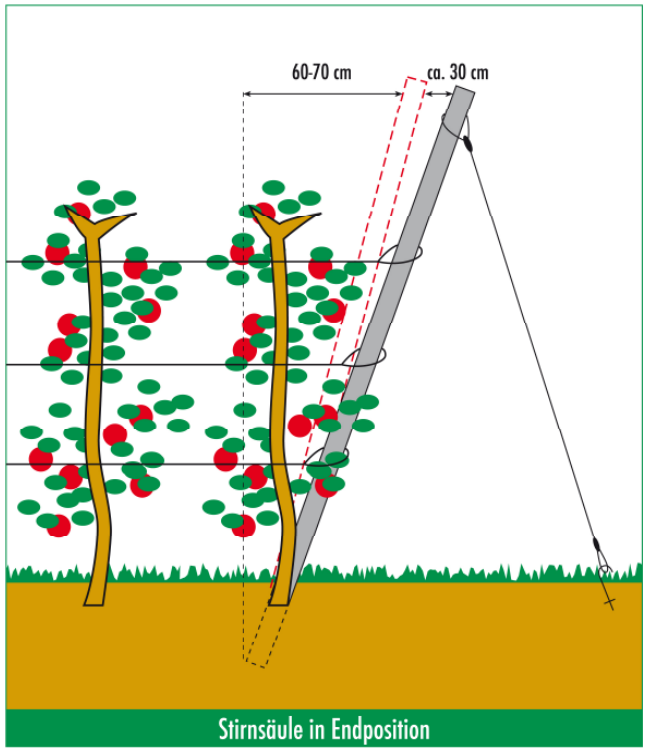
Choice of the adequate anchorage according to the respective soil type, for example:



- ⇨ **Stony, hard gravel surfaces = strike armature**
- ⇨ **Compact mixed soils = screw anchor with a disc Ø 25 cm**
- ⇨ **Usual soils = screw anchor with a disc Ø 30 cm**
- ⇨ **Sandy soils = Rambo strike armature or screw anchor with disc Ø 40 cm**
- ⇨ **Turf soils = screw anchor with a disc Ø 50 cm or Ø 60 cm**

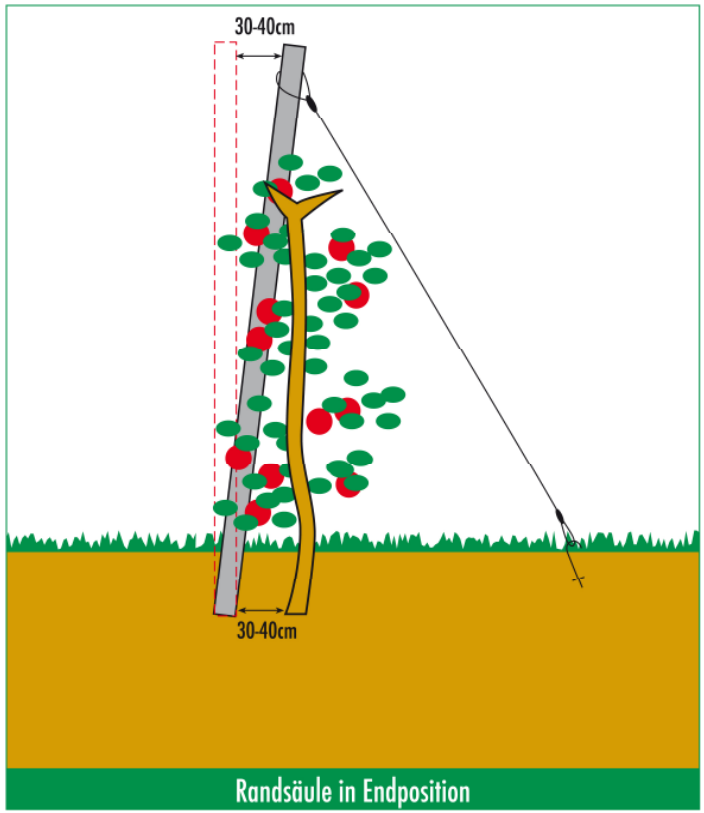
When the anchorage is fixed please bear in mind that column top, column base and anchor have to be in one line in direction of tension of the rope or the wire. There should be a 2 m anchor distance to the column base, but not less than 1.5 m. Any other distance is said to be the second best solution holding a certain risk potential.

COLUMN-, WIRE- AND ROPE SECURING AS FOR INSTANCE THE WIESEL SYSTEM



Anchor rope installation:

8 mm Ø 7 x 7 with steel reinforcement, finely braided EN123 85-4 VZ.
The anchor rope is wrapped around the column top 25 cm beneath the top at the most, making a loop on the side of the anchor. The long and the short end of the rope cross on the back side. These two ends are bolted together under the loop (approx. 30 cm) with two rope clamps; the longer end of the rope is led to the anchor via the anchor's loop, tightened with two brackets and a hoist and fixed with two rope clamps. The front column inclination is 60 – 80 cm from column's top to base and the edge column inclination is 30 – 40 cm from column's top to base.



Ridge wire installation:

The ridge wire is laid out such that there are two excess wires on the left and on the and right side in every second row (distance column top – anchor + 1.5 m). The work platform goes into these rows where there are two wires. The wire is running onto the platform. At each column row it is stopped, and on the left and on the right side the Firstfix is installed on the column top; the ridge wire is laid into the lengthwise furrow of the Firstfix and fixed as loosely as it still possible for the Firstfix to glide until tensioning has been finalised.

Cross wire installation if ridge wires have already been installed on columns:

This cross wire is laid out on the front side with the same excess as the ridge wire, lifted onto the ridge wire and pulled in from two people by means of the work platform going on the left and on the right side and catapulted. Another way is to throw the cross wire crossways to the rows, mounting a 1 kg weight at the end of the wire. The thrower must slip through the framework wire.

Cross wire installation if ridge wires have not yet been installed on columns:

If there have no trees been planted and no structure wire been installed so far, the cross wires are laid over the ridge wires on the ground and automatically lifted together with the ridge wires.

Edge rows, net installation and tensioning of cross wires:

The net width is pressed through the thread bolt of the front-side cap, on it comes a PVC disk, a flat metal disk, a cranked disk, and here the cross wire is inserted, one more flat metal disk, an M 10 nut with which the ridge wire, hail net and cross wire are fixed by tightly screwing them down.

The edge columns are erected in the same way, the only difference is that the hail net is broken through from the end of the cross wire immediately after the clamp supplement. The end of the wire is led to and through the anchor, tensioned with a hoist an and fixed with two rope clamps.

Ridge wire tensioning:

The ends of the ridge wire are led through the anchor loops and tensioned on the ridge with two clamp nuts and a hoist. It would be of advantage to use a second hoist to keep or bring the front side column opposite to the ridge wire in position.

NET INSTALLATION AND NET SECURING, FIXING OF THE NET CONNECTIONS AS FOR INSTANCE THE WIESEL SYSTEM

Hail net installation:

The hail netting of the inner tracks is, just as is the ridge wire, laid out or stretched in two lanes on the ground every second row. However, the work platform is used in those rows without any netting.
Now, the net is put over the ridge wire on the left and on the right side and manually wired to each column with reasonably care. When installing the Firstfix device, ridge wire and the prestressed cross wire is fixed with screws.

Net securing on the ridge:

a) Net stop needles:
One net stop needle is placed at least every 1.5 m, piercing through both net halves closely beneath the ridge wire with these curved needles. The needles are shoved on about 3 cm, and turned, that's it.
b) Sew the netting on the ridge wire:
By means of a sewing machine on wheels the left and the right half of the net are sewed up approx. 1.5 cm beneath the ridge wire.
c)With this sewing machine netting panels can be sewed up at the end of the roll. What is more, net stripes can be sewed on in the plant on the side panels in the right size. The seam of both net halves is trailed in the middle of the track at a right angle to the ridge wire toward the front face rope, wrapped around this front face rope and secured with one needle each. Now a net connection is installed inside, about 30 cm away from the front face rope.
Subsequently, the netting is rolled along the centre of the front side rope, beginning from the end of the panel and tied to the ridge wire at right angles via a tube inserted on the front side rope.
If both panels are tied, a second net connection is installed directly next to the top of the columns.

Placement of the net connections:

The net connections are affixed at a distance of 1.5 – 2 m, bearing in mind that males and females must always be on the same side in the row. Furthermore, please note that from each side and inner column both on the left and on the right side, the net connections' distance is to be 60 cm minimum.

OPERATION AND MAINTENANCE

After the plant has been installed, operational services have to be carried out, differentiating between periodical maintenance and service after a particular incident.

Periodical or seasonal maintenance work

Periodical maintenance work mainly consists of:

- ⇨ Opening and net storage during winter. Please note that all this work has to be done and concluded before the first snow fall. At the same time, winter storage should not be carried out too early so that possible hail damage on the crop can be avoided.
- ⇨ The closing of the netting. Here one has to make the decision whether the closing should be done before or after blossoming.

Maintenance work after a particular incident

Here major weather conditions such as hail, snow, storms and heavy rainfalls are relevant. The following issues have to be checked and, if necessary, maintained.

- ⇨ Are the wires unclamped or broken?
- ⇨ Has/have the anchor(s) come out of the soil?
- ⇨ Columns sunk into soil, primarily pose a danger for the plant if an anchor column has caved in.
- ⇨ Are there problems with net securing on the ridge or net connections in the eaves?
- ⇨ Netting damage?

PROFITABILITY

As to the basic factor whether or not to install a hail net system, the economic point of view must be taken into consideration. We would like to describe this point of view by means of two scenarios; one where hail insurance is included and the other example is documented without hail insurance.

First scenario 1 ha

The assumption is:

- ⇨ Hail frequency every two years with 80 % crop damage
- ⇨ Production 60,000 kg/ha
- ⇨ Sales price class 3 = 0.20 €/kg, sales price class 1 +2 = Ø 0.70 €/kg
- ⇨ Yearly production costs 14,000 €/ha
- ⇨ Yearly expenses for installation and maintenance for hail net system 1,000 €/ha

Ø Annual rate of return with hail netting:
Yearly production 57,000 kg class 1 + 2
Yearly production 3,000 kg class 3 by 5 % scatter damage
57,000 kg x 0.50 €/kg + 3,000 kg x 0.20 € = 29,100 € - 14,000 € production costs – 1,000 €
installation and maintenance costs for hail net system totals an annual outcome at the end of the year with a profit of **14,000 €** per ha.

Ø Annual rate of return without hail netting:
Produced goods:
Year with hail: 48,000 kg class 3 + 12,000 kg class 1 + 2
Year without hail: 60,000 kg class 1 + 2
Corresponds to a Ø yearly production of 24,000 kg class 3 and 36,000 kg class 1 + 2
24,000 kg x 0.20 €/kg + 36,000 kg x 0.50 €/kg = 22,800 € - 14,000 € production costs
sums up to an annual outcome at the end of the year yielding a profit of **8,800** € per ha.

Difference = 5,300 € per hectare and year.

Second scenario 1 ha

Assumption:

- ⇨ Hail frequency every five years with 80 % fruit damage
- ⇨ Production 50,000 kg /ha
- ⇨ Sales price class 3 = 0.10 €/kg, sales price class 1 + 2 = Ø 0.30 €/kg
- ⇨ Yearly production costs 12,000 €/ha
- ⇨ Yearly expenses for installation and maintenance for hail net system 1,000 €/ha

Ø Annual rate of return with hail netting:
Yearly production 47,500 kg class 1 + 2
Yearly production 2,500 kg class 3 by 5 % scatter damage
47,500 kg x 0.30 €/kg + 2,500 kg x 0.10 €/kg = 14,500 € - 12,000 production costs – 1,000 €
installation and maintenance costs for hail net system totals an annual outcome at the end of the year yielding a profit of 1,500 € per ha.

Ø Annual rate of return without hail netting:
Produced goods:
Year with hail: 40,000 kg class 3 + 10,000 kg class 1 + 2
4 years without hail: 50,000 kg class 1 + 2
Corresponds to a Ø yearly production of 8,000 kg class 3 and 42,000 kg class 1 + 2
8,000 kg x 0.10 €/kg + 42,000 kg x 0.30 €/kg = 13,400 € - 12,000 € production costs
sums up to an annual outcome at the end of the year yielding a profit of 1,400 € per ha.

Difference is 100 € per hectare and year

As has already been seen from these scenarios, there can be considerable differences in economy and profitability if basic conditions change. Even so, it is assumed that a hail net pays for itself.

Scenario with hail insurance 1 ha

We would like to add some basic remarks as to hail insurance and hail nets. Depending on area and hail frequency, insurance conditions may vary greatly, also showing big differences in the assessment of damage. As a result, comparisons also show various outcomes.
Please see below some topical insurance conditions:
Styria 14-20 % premium + 20 % retention; South Tyrol 6-11 % premium + 20 % retention
Slovakia 6 % premium + 20 % retention
Assumption:

- ⇨ Insurance conditions Styria, insurance value 40,000 kg x 0.35 € = 14,000 € x 16 %
- ⇨ Premium = 2,240 €
- ⇨ Production 40,000 kg/ha
- ⇨ Sales price class 3 = 0.09 €/kg, sales price class 1 + 2 = Ø 0.30€/kg
- ⇨ Yearly production costs 10,000 €/ha
- ⇨ Yearly installation and maintenance costs for hail netting 800 €/ha

Annual rate of return with hail netting:
Yearly production 38,000 kg class 1 + 2
Yearly production 2,000 kg class 3 by 5 % scatter damage
38,000 kg x 0.30 €/kg + 2,000 kg x 0.09 €/kg = 11,580 € - 10,000 € production costs –800 €
installation and maintenance costs for hail net system totals an annual outcome at the end of the year yielding a profit of **780 €** per ha.

Yearly rate of return with hail insurance at 90 % damage event:
Yearly production 36,000 kg class 3 + 4,000 kg class 1 + 2
Insurance compensation: 14,000 € x 90 % = 12,600 € - 2,800 € retention – 2,240 € premium = 7,560 €
Sales rate of return 36,000 kg x 0.09 €/kg + 4,000 kg x 0,30 €/kg = 4,440 €
4,440 € sales rate of return + 7,560 € insurance compensation – 10,000 € production costs totals an annual outcome at the end of the year yielding a profit of 2,000 € per ha.

Yearly rate of return with hail insurance at 60 % damage event:
Yearly production 24,000 kg class 3 + 16,000 kg class 1 + 2
Insurance compensation: 14,000 € x 60 % = 8,400 € - 2,800 € retention – 2,240 € premium = 3,360 €
Sales rate of return 24,000 kg x 0.09 €/kg + 16,000 kg x 0,30 €/kg = 6,960; €6,960 € sales rate of return + 3,360 € insurance compensation – 10,000 € production costs totals an annual outcome at the end of the year yielding a profit of 320 € per ha.

Fruit Security GmbH
A-8181 St.Ruprecht, Bundesstrasse 278
TEL.: +43 (0) 31 78 / 28189
FAX.: +43 (0) 31 78 / 28189-4
E-mail: office@fruitsecurity.com
Internet: www.fruitsecurity.com