Workbook

eazyplug

OK biobased

TÜV AUSTRIA ★★★★ S2523

THE NUMBER 1 FOR SUSTAINABLE GROWING

plug 'n grow

www.eazyplug.nl

Dear customer,

Thank you for buying Eazy Plug!

With the Eazy Plug System you have chosen to enhance your crop and profitability and at the same time work in a sustainable way.

The self-regulating capability of the system will allow you to quickly achieve maximum results with little effort.

This manual contains information on how to properly use Eazy Plug and optimize your growing conditions. Close attention to the instructions and suggestions will help you to get the best possible results for your crop.

We wish you a successful crop.

Eazy Plug Development Team
HGA International B.V.
The Netherlands

Tabel of content

1. What is Eazy Plug?

Eazy Plug is an innovative, stabilized, biobased growing medium from The Netherlands. Organic components bonded together to a well-controlled growth environment.

With the ability to precisely determine its pH and EC values and its air-to-water ratio, Eazy Plug can be tailored to any specific demand of a grower or plant variety.

The Eazy Plug System covers full cycle growth with its propagation plugs, sequential growing blocks and pyramids.

Even after the best results of our advanced engineering and many years of practical experience and exhaustive testing, we continue to strive for superior reliability and performance.

By now Eazy Plug is being used all around the world, helping various horticulturists grow their crops successfully.

Eazy Plug is biobased certified, obtained from TÜV AUSTRIA.
This certification system is based on the European standard EN 16785-1, which provides for an independent assessment of the claims of biobased ingredients in products.

2. Features of Eazy Plug:

- fixed air-to-water ratio
- air pruning effect
- predetermined pH and EC value
- self-regulating
- unmatched quick water uptake
- very evenly divided moisture level throughout the medium
- 100% compostable
- ⭐⭐⭐⭐ 4 star certified OK biobased
- no transplant shock
- unsurpassed success rate

3. Plan a new crop

- Make a work plan in advance
- Protect the environment by minimizing possible emissions of cleaning agents
- Set up and follow hygiene protocols in order to prevent from contaminations
- Remove all “old” plant material and possibly present floor plastic coverings. Clean up your greenhouse thoroughly. Ask your dealer for a disinfectant that is suitable for your needs.
- Carry out renovations at your greenhouse before crop rotation
- Prevent dirty streams to cross with clean streams
- Clean all premises well
- Prevent leakage from pathogens transmissible by water
- When washing the inside of the greenhouse use clean hot water, do not use surface water
- For drip-feed: thoroughly clean up your complete watering and fertilizing system and all of its components
- For eb & flow: remove dirt and root remains from the system, thoroughly flush and clean up your complete watering and fertilizing system and all of its components
- For drainwater silo: remove sediment and clean

4. Prepare for a new crop

- Test the irrigation system
- Wear gloves when handling the plugs, blocks or pyramids in order to prevent from any possible contamination
- Keep the Eazy Plug products in the packaging until use, to avoid possible damage or contamination
- While unpacking the products, handle carefully to prevent from damaging the substrate. Damage may lead to poor crop settlement and an unevenly plant growth.
- For traceability reasons make sure to keep any relevant delivery information or batch codes mentioned on the packaging.

5. How to use Eazy Plug with clones

Step 1 Moisten Eazy Plug

- Allow the Eazy Plugs to fully suck up water with a pH of 5.8.
- Let it drain out excess water. **Do not squeeze out or dry the plugs**. Eazy Plugs are self-regulating and will only hold the water they need for an optimum moisture level and an optimum air-to-water ratio. The plug will feel much heavier than Rock-Wool, but that's normal.

Step 2 Take clones as described in chapter 7

Step 3 Root stimulator as described in chapter 7

Step 4 Insertion in Eazy Plug as described in chapter 7

Step 5 Put into propagator

- Put the tray with Eazy Plug into a propagator.
- Close the lid of the propagator and shut any present air vents to keep the humidity inside the system.

Step 6 Remoistening and fresh air

- Only remoisten the Eazy Plug after 3 days and keep on doing that every 3 days until the first appearance of roots.
- Briefly open the propagator every day for a little fresh air.
- Open the air vents slightly at the earliest after 4-5 days. Humidity should remain above 80%, as too much loss of humidity can seriously effect your success rate.

Step 7 Assure drainage of excess water

Make sure Eazy Plug is able to drain excess water at all times, so it can always self-regulate the correct amount of moisture. Never let the bottom of the Eazy Plug touch water, as the moisture absorption of Eazy Plug is exceptionally good and the Eazy Plug will quickly become too wet, which will have a negative effect on the rate of success.

Step 8 Open air vents

After the first roots have developed, you can gradually open the air vents further in order to acclimate the cutting to a less humid environment.

Step 9 Transplant

In 7-9 days from start your cutting should have grown its roots throughout the Eazy Plug and it is time to transplant them.

Conditions for developing roots:

- Temperature. The optimum soil temperature for striking roots is 22° Celsius. Above 23° Celsius, you must consider a rise in failure rate.
- RH (humidity). RH of 80-95% is perfect. As the cutting needs its energy for striking roots, the moisture level of leaves and stem should remain intact.
- Light. In the first few days the cutting will form callus, from which the roots will start to grow. In this phase the cutting only needs tempered light with a broad spectrum (regular assimilation light). After the development of roots the amount of light can be gradually increased.

6. The cultivation of mother plants

For preserving genetics or for reproduction purposes, the taking of cuttings (cloning) is one of the most common methods of vegetative propagation. Mother plants that are specifically raised to provide healthy and vigorous clones. Good quality mother plants not only secure a quick and good start for clones, but are decisive for the quality of the entire cultivation.

There are two types of mother plants

1. Permanent mother plant: designated for cloning, topped, tied, and manipulated to provide a continuous supply of good quality clones for a longer period of time.
   + special light and fertilizing for the best possible mother plant
   + high quality consistent clones
   – designated mother plants with a designated growing room
2. Transient mother plant: production plants in vegetative phase, where clones are taken prior to being put into flowering. Each plant provides clones of itself before going into the generative phase (flowering).
   + no need for a designated room for designated mother plants
   – loosing tops and potential buds on your production plants
   – little weakening of production plants due to cut clones

Selecting your mother plants

1. Start a cultivation from different seeds or clones until the plants reach the vegetative phase
2. Take clones of each of them, label them for identification and grow them until vegetative phase
3. Cultivate the original plants (from a) until they reach the generative phase (flowering)

4. Take the crop of the original plants and compare cultivation results such as yield, root structure, stem diameter, resistance against pests and fungi, etc.
5. Select the best performing original plants and use their accompanying previously taken clones as your mother plants

Following the above way of working, you will know exactly what to expect in terms of size, quality and harvest yields.

When is a permanent mother plant ready

After about 2 months the first clones can be taken, but depending on strain, the quality and swiftness of rooting may still be inadequate. The results will be better from a well-established plant. After 3 months, most mother plants are ready to provide good quality cuttings. Younger plants are not yet mature and their clones can take a lot longer to root, or may not root at all. The older the mother plant becomes, the stronger its clones.

Keeping permanent mother plants

Mother plants must be kept permanently in the vegetative phase. Clones are of the same biological age as their mothers and the vegetative phase is the right time for a clone to quickly develop its roots. If a mother plant is already in the generative phase (flowering), the clones will flower as well instead of focussing on developing roots. This distinction is of decisive importance for a quick and healthy rooting of your clone and will eventually be of influence for the quality of your entire crop.

Training permanent mother plants

Training your plant is managing its growth so it produces the harvest the way you want it. Mother plants are kept into the vegetative phase for quite a long time and will become tall, unless the are kept manageable and small. Regularly topping, trimming and pruning of branches of a mother plant is part of its training and will:

- encourage new branches to grow (more clones)
- keep your plant from growing too large
- remove parts of the plant that are not important for growth or harvest, making the plant direct its nutrients and energy to the parts that are important for you (clones)

Another part of training a mother plant is to fixate its branches into specific positions to encourage growth to a specific shape. In general one strives for a wide field of tops, which yields many good clones.

Aging of permanent mother plants

Plant cells age and become less efficient, as their proteins and DNA break down in a slow process of degradation. The older a plant gets, the greater the cumulative effect of this process. Eventually a mother plant will experience enough cellular degradation that the survival rate and quality of its cuttings will be significantly decreased. Time to promote one of her clones to become the new mother plant, securing genetics and new generations of healthy cuttings.

To secure healthy clones and genetics, always keep track of the age of each of your mother plant and its cloning success rate in order to pick the right time to change-over to a new mother plant.
Special note: to prevent against unforeseen circumstances, always keep back-up genetics around.

7. Taking clones

1. Disinfect or sterilize all your tools in alcohol and put on nitrile gloves.
2. Choose new green branching from your mother plant. Non-woody stems root easier than woody stems. Pick a stem with at least 1 node on it. A node looks like a joint on the stem that holds 1 or more leaves or buds.
3. Cut your clone with a straight cut just below a node using a sharp scissor or razor blade. The clone should have a length of between 10-20 cm (5-8”). Preferably all clones have about the same length, so no clone has to fight for light.
4. Place your clones immediately into a glass of water, to prevent the fresh cut from oxygen exposure until you have cut all your clones and you proceed with the next step.
5. Take the fresh clone and use a sharp razor blade to make a clean slice at a 45-degree angle through the middle of the last node or just below the last node.
   - Making the cut through the node increases your chance for successful rooting, as this is natures spot to send out new roots.
   - Cutting on a 45-degree angle enlarges the surface area where the callus is formed and where the roots start sprouting
6. Gently scrape of the hard epidermis (outer layer) of the bottom part of the clone so more “raw” insides get exposed. This again gives more surface area for roots to sprout, promoting faster rooting. Do not scrape off more than the planting depth. Scrapped off parts that remain above substrate will lead to failure.
7. Remove all but 2 or 3 top leaves. All lower leaves should be taken away in order to reduce evaporation surface and to ensure energy savings. If the remaining top leaves are large, clip about 30-40% of the top of the leaves for the same reason.

8. Take some rooting hormone powder from the original container and put it into a separate small container. Do not dip the clone directly into the original container and never return used rooting hormone to the original container either, as the powder is activated after contact with clones.
9. Put the node end of the clone into water and then dip or roll it into the hormone powder. Don't apply the hormone powder any higher than the planting depth. Tap off the excess hormone powder by lightly tapping the clone against the edge of the container. Too much rooting hormone decreases your success rate. Rooting hormone is not a necessity, but it does increase speed and success rate.
10. Carefully place the clone all the way into the pre-punctured cutting holes of the Eazy Plug. Make sure to insert the clone deeply enough, completely to the bottom of the cutting hole. The pre-punctured cutting hole ensures that the rooting hormone remains on the stem of the clone instead of being rubbed off.

Note:

At step 3, one can also take the cutting right away from the mother plant at a 45-degree angle. However to minimize the wound for the mother plant and to accelerate its recovery it is advisable to:

1. start with a straight cutting an cut the clone afterwards at a 45-degree angle as described above.
2. pinch the upper top of the straight cut on the mother plant with your nails (gloves on) in order to somewhat reduce the open wound.

8. How to use Eazy Plug with seeds

Step 1 Moisten Eazy Plug

- Allow the Eazy Plugs to fully suck up water with a pH of 5.8.
- Let it drain out excess water. **Do not squeeze out or dry the plugs.** Eazy Plugs are self-regulating and will only hold the water they need for an optimum moisture level and an optimum air-to-water ratio. The plug will feel much heavier than Rock-Wool, but that's normal.

Step 2 Sowing

- Plugs with seed gap: Place the seed into the preformed seed gap. Cover the plug (including seed gap) with a thin layer of top soil (Eazy Mixx) of 1-2 mm. Cautiously spray water on top of top layer soil to moisten it thoroughly en to ensure a moistened seed and top layer soil.
- Plug with cutting hole: In case of a cutting hole ensure the seed is not too deep and do not press it in too deep. You can break off a small corner of the plug and put it into the top of the hole to cover the seed, but that should never be more than a layer of about 5 mm. For most seed types this covering is not a necessity. After sowing, sprinkle the plug shortly with some water, to ensure the seed is wet.

Step 3 Put into propagator

- Put the tray with sown Eazy Plugs into a propagator.
- Close the lid of the propagator and shut any present air vents to keep the humidity inside the system.

Step 4 Assure drainage of excess water

Make sure Eazy Plug is able to drain excess water at all times, so it can always self-regulate the correct amount of moisture. Never let the bottom of the Eazy Plug touch water, as the moisture absorption of Eazy Plug is exceptionally good and the Eazy Plug will quickly become too wet, which will have a negative effect on the rate of success.

Step 5 Await germination

Until the first appearance of a seedling, one should always keep the Eazy Plug moist enough. The Eazy Plug itself contains sufficient moisture for germination and with the use of a completely closed propagator the moisture remains into the system and the Eazy Plug and seeds are not likely to dry in those first few days. Loss of moisture caused by an open lid or air vent can cause rapid dehydration, which can seriously effect your success rate.

Step 6 Open air vents

Once seeds have germinated and a seedling has grown, one can gradually open the air vents in order to acclimate the seedling to a less humid environment.

Step 7 Transplant

After germination the seedling will quickly grow its roots through the Eazy Plug. When the first roots have become visible, it is time to transplant your plug with seedling.

Germination conditions:

1. Temperature: The optimum soil temperature for germinating seeds is 20-25 degrees Celsius. However, make sure that the seed itself is no warmer than 25 degrees Celsius. Take into account that most lamps generate radiant heat which raises the temperature of the seed itself to a higher level than the temperature of the air or soil. To avoid any risk, a seed temperature of 22-23 degrees Celsius is advisable. Above 25 degrees Celsius, you must consider a serious failure rate for most seed varieties.
2. RH (humidity): RH of min. 80% is perfect for the seeds and Eazy Plug to not dry out.

3. Light: In general there are not a lot of seed varieties where light is an absolute requirement for germination. For most seed types, the application of an additional light source will only lead to a risks of excessive heat development of the seed (radiant heat) and dehydration of both seed and plug. Just daylight or even a dark room situation will be OK for most seed types to germinate. Should you decide to put in an additional light source, then realize that most seeds only need very little light of a certain color.

9. How to use Eazy Block

Step 1: Moisten Eazy Block

Prepare water with a pH of 5.8. On personal preference you can add a root stimulator to the water. Allow the Eazy Block to fully suck up the prepared water. Let it drain out excess water. **Do not squeeze out or dry the blocks.** Eazy Blocks are self-regulating and will only hold the water they need for an optimum moisture level and an optimum air-to-water ratio. The block will feel much heavier than Rock-Wool, but that's normal.

Step 2: Put plug in block

Put the Eazy Plug with cutting or seedling in the hole on the upper side of the Eazy Block. It will fit nicely and you will not encounter a transplant shock.

Step 3: Remoistening

Only remoisten the Eazy Blocks when they start to show lighter braun spots.

Step 4: Fertilizing

Only after 5 days start remoistening the blocks with a light fertilizing mix with an EC of 1.2-1.4 and an pH of 5.8.

Step 5: Transplant onto Pyramid

In 4-5 days your young plant should have grown its roots throughout the Eazy Block. By then roots have already started to elongate from the block. After maximum 5-10 days Eazy Block should be transplanted onto the Eazy Pyramid.

10. How to use Eazy Pyramid

Step 1: Moisten Eazy Pyramid

Prepare water with a pH of 5.8 and an EC of 1.4. Again on personal preference you can add a root stimulator to the water. Allow the Eazy Pyramid to fully suck up the prepared water. Let it drain out excess water.
Do not squeeze out or dry the Pyramids. Eazy Pyramids are self-regulating and will only hold the water they need for an optimum moisture level and an optimum air-to-water ratio.

Step 2: Put block onto pyramid

Put the Eazy Block with young plant simply on top of the Eazy Pyramid. It will fit there nicely and will continue developing its roots inside the pyramid without a transplant shock.

Step 3: Remoistening

For quick root development, only remoisten the Eazy Pyramids after 3 days from start and in optimum climate conditions even only after 5 days. Remoistening can be done by all known techniques, like drip-feeding, eb and flow system, manual, etc.

Step 4: Fertilizing

After 5 days start adding a light fertilizing mix to the water up to an EC of 1.2-1.4 and a pH of 5.8.

Step 5: Determine optimum EC

The air pruning effect generates a much more advanced root structure with a much bigger hair root mass and with it an increased uptake capacity. As a result many growers can suffice with an EC value that is +/- 0.2 lower than in older traditional substrates. On first sight of leaves getting lighter green, you should raise the EC immediately back with 0.2. With the Eazy Pyramid material it will take considerably longer for the leaves to grow lighter than with ordinary pots or Rock-Wool, if it already occurs.

11. Using drip emitters

Irrigation via drip emitters is a well controlled way of watering and fertilizing the Eazy Pyramids. As the Eazy Plug and Block cover the first two phases where the demand and frequency of watering is low, there is no advantage or necessity of using drip emitters for those phases.

Optimal position of drip emitters in Eazy Pyramid

- +/- 1.0 cm. (0.39 inch) underneath the top of the Pyramid
- at an angle of 30-45 degrees
- 2 drip emitters on opposite sides of the Pyramid

Flow of drip emitters

The type of drip emitter and the flow depend on variables such as:

- evaporation: depends on humidity level of growing room and the ventilators present
- water intake plant: depends on size and phase in plant cycle
- the amount of overflow the grower like to use

General guidelines for using drip emitters in Eazy Pyramid

1. Moisten Pyramid and let it drip the excess water. The Pyramid will self-regulate to exactly the right air-to-water ratio. Put a rooted Eazy Block onto the center of the Pyramid
2. Put 2 drip emitters in opposite sides of the Pyramid, following the above instructions at “Optimal position of drip emitters”
3. Make sure your ventilators are NOT working. Just after transplanting they are not needed yet and they will have a huge impact on the evaporation of your substrate and plant. Ventilators will accelerate the drying out of the substrate considerably.
4. In those first 2-3 days you can do without your drip feeding system in action. The just transplanted plant is still small and uses little water and the Pyramid holds a lot of water (when the ventilators are out).

5. After about 2-3 days the Pyramid will start to show lighter brown spots and you can start watering with your automatic drip cycle at a rate of about 1 liter (0.265 gallon) a day per plant. This is the moment to put your ventilators on again as well.
6. About 2 weeks after transplanting the Eazy Block onto the Pyramid, your plant should have evolved to a size that it needs about 2 liters (0.53 gallon) a day and you can adjust the watering likewise.

Why not start the drip cycle right from the start?

Making use of the above watering instruction will result in the Pyramid gradually becoming a little drier in the first phase after transplanting an Eazy Block with plant onto it. This is exactly what we want, because the roots will start looking for water, resulting in an accelerated rooting speed. Make sure to keep a good eye on the Pyramid and plant:

- Once the Pyramid starts to show lighter brown spots, it needs watering and you need to start your drip irrigation immediately.
- The leaves of the plant can be used as an indication as well. Make sure the leaves do not start hanging due to lack of water. Already at the first sight of tips of leaves starting to hang down a little, start your automatic drip cycle immediately.

Once starting up the drip cycle and providing the plant with the right moisture levels, there will be an accelerated development of the plant in the beginning.

Extra remarks or suggestions when using drip emitters

- A popular schedule for growers is to water about 6 times a day with an automated drip emitter system, thus creating a very stable and constant pH and EC level.
- Most professional growers that re-use their collected water, like to work with an overflow of about 30%, but everybody has its own preferences and systems with collected drainage water.
- In the last flowering phase most growers tend to calculate with a daily intake of about 0.5 liters (0.14 gallon) per plant. The rest of the watering flow is mostly compensating the evaporation rate and creating the overflow the grower likes to work with.

Continuity of drip irrigation schedule

The industrial way of processing and producing the Eazy Pyramid substrate guarantees the same air-to-water ratio for each single Pyramid. So at the first start there is an effort needed by the grower in checking moisture levels of the substrate and controlling and adjusting the pump, but later on a grower can trust on working with the same values for each cycle.

12. Air pruning effect

No wrapping

Due to its strong stabilization there is no need for a wrapping or a pot. This allows for air pruning, a natural proces that results in a greatly enlarged hair root mass.

Air pruning

When there is no sleeve, wrapping or pot enclosing the medium, the roots of the plant will elongate from block or pyramid and come into relatively dry air. This causes the apical cells at the tip of the roots to dehydrate, or become air pruned. This effect stimulates the growth of secondary roots, branching out the original roots and growing within the medium. Again these secondary roots spread throughout the Eazy Block or Pyramid until they reach the outer sides where they get air pruned again, stimulating more root growth. The overall effect is the establishment of a much more well-developed root system that is evenly spread out.

Hair root mass

The actual uptake capacity of the root system is in its hair roots. Hair roots only occur on the latter part of roots. Branching out will not only generate a strong root structure, it will generate hair roots at each tip of a branch.

Beneficial effect of air pruning

As a result an Eazy Block or Pyramid will be fully grown with smaller branched out roots. This way there is an abundant growth of hair roots inside the entire medium, making optimal use of water and nutrition.

Comparison with sleeved material like Rock-Wool

With sleeved material, the roots start elongating from the medium as well. Due to the sleeve, they enter into a humid environment between medium and sleeve. Roots will not get air pruned and keep on growing downwards between sleeve and medium. There is no stimulation to develop secondary roots. As hair roots only develop at the latter part of a root, those few big roots elongating from the medium will hardly contain any hair roots and with it hardly any uptake capacity inside the medium.

Comparison with plastic pots

Growing from the center, the roots will grow to the outside until they encounter the wall of the pot. Roots will remain into soil and keep on growing alongside the wall of the pot. This so called “winding” will lead to a few long roots with practically no branching, again resulting in just little hair root mass only at the latter part of those big winding roots with hardly any uptake capacity.

13. Self-regulating

Eazy Plugs, Blocks and Pyramids can be tailored to customer needs. In production the major characteristics can be predetermined, like:

- mixture of raw materials
- pH
- air-to-water ratio
- EC
- drainage capacity
- flexibility

Some of these values can be slightly buffered as well.
This not only results in a very easy-to-use material, but also in the most stabile grow environment for your plant and roots.

Self-regulate

When the Eazy Plugs, Blocks and Pyramids are able to drain the excess water, they will self-regulate to exactly the right air-to-water ratio and hold the optimum amount of water by themselves.

No overwatering

Assure drainage and overwatering is not possible.

Drier cultivation

In specific phases of development it is sometimes desirable to make roots search for water or to raise the dry-mass of the plant. Cultivating drier with the Eazy Plug System is easily done with a lot of control. All remaining moisture content will be very evenly spread out throughout the medium and with it the pH and EC. Remoistening is quick and simple as the medium takes water back up easily.

Make sure the Eazy Plugs, Blocks or Pyramids are able to drain the excess water at all times.

14. Analyzing EC

EC = Electrical conductivity = the reciprocal of electrical resistivity, and measures a material's ability to conduct an electric current. The SI (International System of Units) of conductivity is S/m at 25 °C., unless otherwise qualified. 1 EC = 1 mS/cm

Temperature influence:

The conductivity of a solution is highly temperature dependent, therefore it is important to either use a temperature compensated instrument (ATC), or calibrate the instrument at the same temperature as the solution being measured. As the temperature of a solution increases, the mobility of the ions in the solution also increases and consequently this will lead to an increase in its conductivity. Therefore it is mandatory to always associate conductivity measurements with a reference temperature of 25° C. (standard temperature), unless otherwise qualified.

Comparing results of EC methods:

There are different methods of analyzing the EC-value of potting soil. Each with its advantages and disadvantages. The more controlled and reliable, the more useful as a comparative tool, but of course the more simple and fast methods are the most easy to use in the field. To be able to make use of EC-values in regulating soil and plant life, it is very important to know that all analyzing methods have their own results, which are not interchangeable. The amount of water used to extract plant-available nutrients and other details of the analyzing methods can give large differences in results. Always use the interpretative data that match the analyzing method you used, otherwise you could make an incorrect interpretation of the results. Therefore each EC-value should always state the analyzing method to make it a useful value for the reader.

Soluble salt levels determined by a few of the different analyzing methods:

1:2 Method	SME	PourThru	Indication for plant
0-0.03	0-0.8	0-1.0	Very low
0.3-0.8	0.8-2.0	1.0-2.6	Low
0.8-1.3	2.0-3.5	2.6-4.6	Normal
1.3-1.8	3.5-5.0	4.6-6.5	High
1.8-2.3	5.0-6.0	6.6-7.8	Very high
>2.3	>6.0	>7.8	Extreme

Optimizing soil analysis:

Collect samples which best represent the nutrient status of the crop or the problem to be diagnosed. First identify the crop unit(s) to be sampled (bench, greenhouse, etc). In a mixed greenhouse, crops of different species must be sampled separately for the tests to have any value. For diagnosing a problem, it is best to have a sample from both normal and abnormal plants for comparison.

To sample, from each crop unit at least 5 pots or flats should be chosen at random. Those 5 are mixed into one sample analysis per crop unit, this way representing the crop as a whole.
For the volume testing methods (1:1.5 or 1:2) and SME method, the actual soil sample is taken by either a core or composite sample from all depths in the pot or from the root zone only. Never sample from just the surface as nutrient and soluble salt levels will always be much higher here than in the root zone and composite samples. As a result CE-levels would be higher and fertility would be overestimated.
Sample about 1-2 hours after fertilizing or at least on the same day. If slow-release fertilizer pellets are present, try to pick them out. If the pellets are left in and they break during testing this may result in an overestimation of fertility.

Be consistent in all sampling procedures each time you sample. A lot of variability can be introduced to tests due to inconsistent sampling. The value of analyzing will diminish with such variability, especially if you are trying to track fertility.

1:1.5 volume method for potting soil:

The potting soil is brought at a prescribed water content by adding demineralised water up to the level where the solution just can be pinched through the fingers. A defined volume of this potting soil is extracted by filling it into a cylinder up to a defined level under a defined compression. The extracted potting soil is thoroughly mixed with exactly 1.5 times the volume of the cylindrical level of the potting soil. The EC-level of the mixture is measured with calibrated EC measurement equipment.

Advantages of the method:

- very accurate and reliable
- high consistency in repeated measurements provide good comparative results

Disadvantage of the method:

- necessity of accurate handling and specialized instruments
- more time consuming and difficult in the field
- In professional horticulture this method is popular because of its accuracy, reliability and consistency. Depending on region, application or horticulturist, several varieties of this method are being used (for example 1:2 method, 1:5 method), of course all with their own non-interchangeable results but with the same consistency.

1:2 volume method for potting soil:

In this test an air-dried sample of soil and water are mixed together in the volume ratio of 1 part soil to 2 parts water (using a measuring cup). The liquid extract is then separated from the solids using laboratory grade filter paper or a common coffee filter. The extract is then ready for analysis. This is a very easy test to master and quite suitable for on-site greenhouse testing of pH and soluble salt using the so-called pH and EC "pens" available from

greenhouse suppliers. The 1:2 method is a very good choice for occasional pH and soluble salts testing by growers on-site.

PourThru method (also called drain method):

With this method, a container with medium in it is elevated above a collection vessel suitable for collecting leachate from drainage holes. Enough distilled water is added to the surface of the medium to collect 50 milliliters (ml) of leachate from the container medium. The moisture level of the container medium should be at or near container capacity before starting this method. At least 5 samples or containers should be tested.

Advantages of the PourThru method:

- extraction and analyses can be done on-site
- plants do not have to be sacrificed or disturbed for testing
- time required for extraction is short and no preparation of medium
- specialized equipment for extracting the solution is unnecessary

Disadvantage of the PourThru method is mainly a poor liability, as:

- the moisture level in the medium should be exactly similar each time
- water may channel in the medium causing erroneous results
- variety in ml. of water poured through

The PourThru Method is best used for continuous monitoring and graphical tracking of pH and soluble salts. An irrigation and leachate protocol must be established and carefully followed to make this method work best. This method is not a good choice for casual checks (use volume method for this) as the "numbers" are often quite variable, inconclusive, and probably unreliable.

Squeeze method:

With this method, irrigate the substrate with diluted water until it is thoroughly wet. Sample substrate from at least 5 plug trays and mix the sample to ensure uniformity. Place the collected sample in a paper towel (cheesecloth) and squeeze the solution from the substrate into a cup. Measure the EC directly in the extracted solution.
Advantages of the method:

- more representative as no subjective addition of the correct amount of water is involved
- extraction and analyses can be done in the field
- simple and fast
- specialized equipment for extracting the solution is unnecessary

Disadvantage of the method is mainly a poor liability, as:

- variety in water wetness of medium, gives other results
- variety in squeezing gives other results

Saturated Media Extract (SME):

In this test a saturated paste is made using a representative sample of the media and deionized water. After 90 minutes, the liquid portion (the extract) is separated (filtered under suction) from the solid portion for pH, soluble salt, and nutrient analysis. Special skills and laboratory equipment are required to perform this test. SME is probably not suitable for a grower to use, unless the greenhouse operation is large enough to support a lab, to have a technically trained person to carry out the tests, and with a commitment to frequent testing and tracking of the results.

15. Mycorrhizae

The word mycorrhiza is derived from the Greek mukès meaning fungus, and rhiza indicating root. Mycorrhizae is a beneficial symbiose of fungi and plants through the roots.

Main reasons for using mycorrhizae are protection against pathogens and increased absorption. By colonizing a medium, the mycorrhizae withholds pathogens from infecting the medium.

Mycorrhizae can increase the absorption capability of a root in:

1. a physical way: most mycorrhizal mycelia are much smaller in diameter than the smallest hair root, and is therefor able to explore soil material that roots cannot reach. This way it provides a larger surface area for absorption.
2. a chemical way: cell membranes of fungi differ in chemistry of that of plants and are able to release or secrete beneficial ions.

Mycorrhizae are especially beneficial for the plant partner in nutrient-poor soils.

There are many different varieties of mycorrhizae, but almost all of them are vulnerable and weak. Even the EC of plant nutrition can already kill them. For most cultivations a weekly dosage is therefor needed to make use of their beneficial effects.

With all its natural components, Eazy Plug is very well suitable for the use of mycorrhizae. Between all different varieties and brands that are being used, natural compost tea's are still popular.

16. Algae

What is an algae:

Like all plants, algae convert carbon dioxide (CO2) and water with the addition of sunlight into carbohydrates and oxygen through photosynthesis. The light is caught by pigment, of which the green chlorophyll is the best known one. In addition, algae also need nutrients, such as nitrate and phosphate. Using carbohydrates, these inorganic elements are converted into organic substances, such as proteins and fats.

Green algae have chlorophyll as their main pigment, which makes the cells strongly greenish. In addition to chlorophyll, blue algae have a blue pigment that absorbs light. Blue algae are actually no microscopic plants but bacteria. Unlike plant cells, blue algae and other bacteria do not have a nucleus. Therefore, they are officially called cyanobacteria. Cyan refers to their blue-green color. The availability of nutrients, such as nitrate and phosphate, determines where algae can grow.

Algae is a simple plant organism. When given the proper conditions, it may be found growing on the surface of each growing media. Algae appears as a green slime covering the soil. By itself, algae is not dangerous to plant life, but it may lead to associated problems.

Algae sources:

The cells and spores of algae are found everywhere. Irrigation water is the most common source, especially if it comes from a pond or shallow well. Water lines can also have a significant biofilm build-up on the inside walls of the pipes, which is mostly composed of algae. If a water source has high levels of algae, there are often algae growing on walkways, walls and benches that are in frequent contact with the water. Other sources include dust originating from the outdoor soil that gets blown into the greenhouse and eventually onto the growing medium, which becomes "contaminated" with algae spores.

Symptoms:

Green slime growing on the surface or sides of soil.

Associated problems:

- If algae is allowed to dry out, it can actually create a seal on the surface of the soil which may reduce the availability of oxygen and/or inhibit the soil's ability to absorb water.
- Algae can bring insect diseases. Fungus gnats and shore flies are lovers of such environments. These are not only a nuisance when they are in adult flying stage, but can also cause root damage in larvae stage or transfer plant pathogens through their mouth parts.
- If greenhouse glazing has algae growing, it restricts light transmission.

Controlling:

- Start by checking your water source. If present in the watering system, it will need to be cleaned out and kept clean. Known treatments are for example chlorine dioxide, copper ionization, hydrogen dioxide, etc. Take special attention for water coming from ponds or shallow wells as it may contain large algae loads.
- If water sources are clean, remember algae can come in from anywhere. Algae need light, fertilizer nutrients and water to grow. Light and fertilizer should not be restricted as they may have a negative impact on your plant growth, but often water can be limited to reduce algae growth. Algae need moist to wet conditions, so by drying the Eazy Plug medium until its surface turns to a light brown color, you will create a hostile environment for algae.
- Other helpful tips are to increase the airflow within the greenhouse to encourage a faster dry-down of the Eazy Plug's surface, or to increase the air temperatures which will lead to the same effect.

Prevention:

- Prevent from overwatering: As the Eazy Plug material is completely self regulating with its air-to-water ratio, this precaution is not needed. However for regular potting soil, the key to prevent the growth of Algae on the surface is to make sure your plant is receiving the proper amount of water. Keep in mind that proper watering is not simply a factor of quantity and frequency. It is also a factor of how much water your potting soil holds in relation to the amount of water your plant is able to absorb. If the soil holds more water than your plant can absorb, it may be the result of an over-watering program combined with inadequate drainage.
- If weather is humid (wet season) try to use a potting mix that is light and porous (use coarser textures or mix with perlite). This too cannot be an issue for Eazy Plug material as the porosity of the Eazy Plug material is predetermined and will remain identical during the full cycle. Unless your plants require a different pH value, try to use potting soil that has a pH between 5.8 and 6.2 (typical SAB substrate range). Eazy Plug has a pH of around 6.0.
- The safest method to prevent algae from growing is to simply cut off its supply of light. Most types of algae need a lot of light. By shading the area around the medium (though not the plant), you will cut off the supply of light that algae need to thrive. If you want to make use of the positive effects of air pruning, the Eazy Block and Eazy Pyramid should be used without plastic sleeve, resulting in more exposure to light. Therefor it is possible that Eazy Blocks and Pyramids mildly suffer from algae, especially the outer rows on tables. This will not harm plant life and usually does not need treatment.

Treatment:

Here are some recipes that could be tried when avoiding chemicals. Results can differ depending on water hardness and soil characteristics.

- Water with light chamomile tea
- Mix 1 part peroxide with 10 parts water and spray lightly onto algae. One can also add a small amount of this mixture regularly to the nutritional water. The roots get an oxygen boost and algal growth will be inhibited. Look out for young plants because young root systems can be damaged by the hydrogen peroxide.
- Spray algae with a solution of 2-3 tea spoons baking soda mixed with 1 liter water.
- For larger surfaces, try to use chemical Algaecides. However that usage must be carefully monitored especially when edible plants are grown (vegetables).

PLEASE USE THESE SUGGESTIONS WITH CAUTION AND ALWAYS TEST BEFORE APPLYING ON LARGER SCALE

17. Molds

Molds will grow on almost any organic source if the humidity is high enough. Molds are created by filamentous fungi that are omnipresent in the environment. Each specie has different preferences for certain types of organic food sources, ranging from wood to plant debris.

Saprophytic:

Eazy plug material is no different from organic matter, so if molds would occur they are most likely saprophytic. This means that they feed on dead plant material and are not pathogenic or harmful to plant life or people.

How does mold arise:

The combination of nutrients, moisture and temperature favor mold formation.

- during storage or shipping: when storage temperatures are high in the summer, moisture can collect between product and packaging and can cause mold to sporulate or develop
- during cultivation: the presence of spores in air, growing media or hardware can lead to developing micro-organisms when combined with excessive moisture and warm temperatures

Beneficial effects:

Some saprophytic organisms are beneficial for plant growth, like the Trichoderma species frequently found. Other species like Penicillium and Aspergillus decompose organic matter, releasing mineral nutrients for plant uptake. All saprophytic molds will contribute to good microbial diversity in the growing medium, this way limiting the occurrence of plant pathogens.

Adverse effects:

In real severe cases, molds can colonize the surface of a growing medium too abundant and form a layer on the surface that limits water penetration.

Effects:

Exposure to fresh air will already inhibit the microbial development by drying it out and the oxygen will shut down micro-organisms that create the odors. If there is some odor, it will dissipate over time.

Treatment:

Molds can be controlled by:

- reduce irrigations
- increase air flow
- fresh air to inhibit the microbial development by drying it out and oxygen to shut down micro-organisms that create the odors
- apply fungicide such as Amylo-X from Certis (a biofungicide that is admitted to the US market as well - it is therefor well suitable for combatting fungicides that occur during cultivation)

18. Mite

Since the use of broad-working resources is less, the problems with mite have seriously increased. Among them the week-skin mites (Tarsonemidae) who form an important group. They are minuscule mites, barely perceptible to the naked eye. Their presence is only noticed when already irreparable damage has been caused in the form of leaf discoloration and/or growth distortions.

Description:

Week-skin mites form a large family, with more than 500 described species, divided into about 40 genera. They are distributed worldwide and are found on a wide range of plant species. Only a limited number of species are known to cause damage. Most of them feed on fungi, algae or other mites or parasitize on insects.

Week-skin mites are prone to dehydration and prefer shady and humid places. This is in contrast to the much more common spider mites, which thrive in warm and dry conditions. Week-skin mites are barely visible to the naked eye (0.1 to 0.3 mm), and can end up in very narrow gaps.

Life cycle:

Male mites are smaller than female mites. Their eggs are transparent, oval and quite large in relation to the body of a mite. Eggs are often deposited individually, sometimes in small clusters. From the egg comes a 6-legged mobile larva, followed by a resting phase, the manikin. This manikin is legless and does not absorb food. The life cycle is extremely short, about 15 days at 15° C. and only 5 days at 25° C. This results in a very high multiplication speed, higher than with any other greenhouse plague. In heated greenhouses mites are active all year round and continue to reproduce.

Damage:

Some species of week-skin mites suck on plants, preferably on the youngest parts of the plant. The most harmful species secrete a toxin, which results in died off growth parts and buds die. Due to the collapse of the growth, nitrogen accumulates in the leaves, which get a dark green color, sometimes with a bronze-colored glow. Shoots deform, leaves become crooked and become stiff and brittle. Plant parts that are still under development can burst open. Heavily infested plants, even after successful control, sometimes need a considerable time to resume their growth. The described damage images can easily be confused with virus attack or phytotoxicity of pesticides.

In the long run, the affected plants are also unpalatable for the mites themselves. As a result, plant parts with clear symptoms are often left by the mites. This has led to the misunderstanding that a small number of mites can do a lot of damage. However, the mites must be searched for on still fresh looking parts close to the visibly affected leaves.

Causes of infection:

Infections can occur due to many different causes, of which the most common ones are:

- Human transmission: Mites stick to clothes, hair or human skin and get transported to other locations (mites often come in plagues at different facilities). For this reason most professional horticultural facilities have strict access controls and make use of thorough rinsing and cleaning before entrance and the wearing of designated clothing. Nowadays often visitors form outside, like representatives (sometimes even called walking contaminants), are no longer allowed into the growing area's.
- Transmission via other means, like tools, substrates, etc.
- Transmission via legs or body of insects, like whiteflies, etc.

Control:

- The acaricides fenbutatinoxide (Torque), abamectin (Vertimec), milbemectin (Milbeknock) and pyridaben (Carex) are used against molluscs. Because the population moves to new growth area's each time, they escape the residue effect of acaricides. A one-off spraying is therefore usually not sufficient.
- Publications include the use of dimethoate (Perfekthion), spirodiclofen (Envidor), spiromesifen (Oberon), acequinocyl (Cantack), tebufenpyrad (Masai), NeemAzal (azadirachtin), pollinated sulfur and mineral oil. Products based on plant extracts are mentioned as well, such as Manipueira, a liquid extract of cassava plant roots and rapeseed oil. In the Netherlands all of these substances are used little or no against mollusc mites.
- Small predators, in particular predatory mites, are eligible as natural enemies. However in practice there is little experience with biological control of these pests.
- In Dutch horticulture growers often make use of the following 2 phase approach:
  1. Vertimec is often used, diluted with a rate of 20cc. at 100L water. In order to break the entire cycle of the mite, dosing has to be done repeatedly within 3 weeks and with fairly high dosages. Dosing at least every 5 days. For improved performance it is advised to add sugar to the mixture at a dilution rate of 10kg per 100L mixture. Mites hide in small gaps within new growth material and cannot be reached with pesticides. Mites are fond at sugar and by adding sugar they are being pulled out of their hiding place.
  2. The above first step is then followed by 3 weeks of applying Skelpa (Certis), at a dilution rate of 100ml per 100L water. No sugar should be added to this. Again thoroughly moisten the plant with the dilution.

For whatever use of pesticide, always ensure that the concentrations stated on the packaging are not exceeded and followed strictly.

19. Storage and handling

Storage:

- store in a covered and dry place
- do not place in direct sunlight
- keep between 5°and 25° C (40° and 77° F)
- maximum temperature variation ΔT < 5°C/h (ΔT < 1,8° F/h)
- store in a place with an RH < 75%
- keep the packaging closed until use
- If unboxed, keep dust-free

Handling:

- do not throw the boxes
- maximum height for stacking: 2.40 m. (7,5 Ft)

20. Customer Support

All Eazy Plug products are being distributed by selected partners worldwide. All selected partners are being supported by the Eazy Plug Team en are able to provide you with information or assistance.

Other ways to get support:

Write to:

HGA International B.V.
Customer support Eazy Plug
Tijvoortsebaan 2
5051 HJ Goirle
The Netherlands

Email to:

support@eazyplug.nl

Fill in form at:

http://www.eazyplug.nl/#contactus

21. Trademarks

Eazy Plug®, Eazy Block®, Eazy Pyramid® and Eazy Mixx® are registered trade marks from HGA Garden B.V.

22. Notes