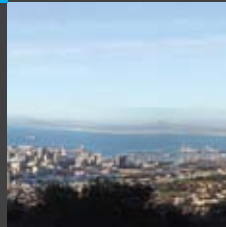




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Soil Blocks

A Zero Waste Option in Seedling Production

September 2009

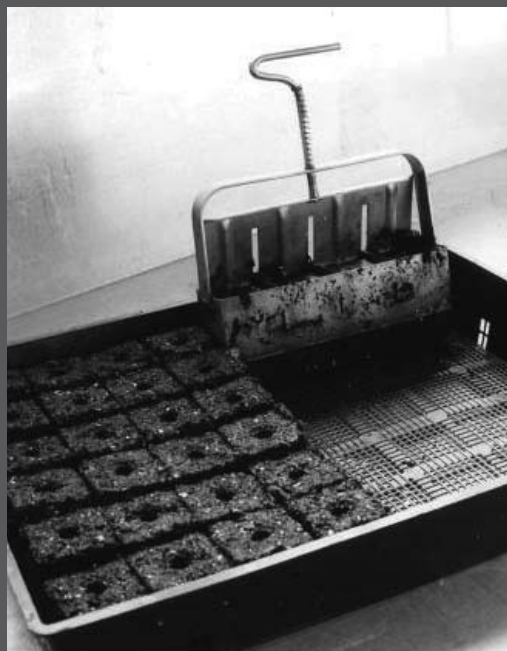


by the Institute for Zero Waste in Africa
(IZWA)

SOIL BLOCKS

Chinampas is an ancient system of agriculture from Mexico. Soil blocks (chapines) eliminate the need for toxic polystyrene seedling trays, or wasteful plastic pots, while improving the survival rate of seedlings, through greatly reduced root disturbance; availability of more nutrients; potential for earlier sowing; and reduced input costs, while maintaining an organic approach.

This booklet explains what they are; how they work; how to make your own soil blockers and soil blocks; and common mistakes made in the use of soil blocks.



WHAT ARE POTTING BLOCKS?

Potting Blocks, also known as soil blocks, are free-standing compressed cubes of potting soil which hold their shape without any container. Potting Blocks are made from all kinds of materials. Potting Blocks are used for seed starting or germination, and transplanting. They have an amazing success rate due to the volume of soil compressed in the cube. The roots are naturally “air pruned” due to the air barrier of the “container-less” cube. They become the growing medium and the container! They are used for everything; herbs, flowers, vegetables, cuttings, and other transplants.



Potting Blocks have many advantages over traditional potting methods:

- They eliminate transplant shock!
- The seedling and root system stays intact and protected, a “home away from home”.
- They will not become “root-bound”.
- They eliminate root circling. They replace plastic pots, trays, inserts, etc.
- They contain more cubic volume of soil than pots of the same top dimensions.
- They promote great air circulation.
- They have a major increase in space utilization than round pots.

And, studies in Europe have shown that Potting Block transplants are superior in performance than container-bound transplants.

WHERE DO THEY COME FROM?

Soil blocks have been used in Mexico for over 2000 years! Has anyone ever heard of the “Floating Gardens” of Mexico City?

About the same time Christ was born, a tribe of Aztecs in central Mexico were trying to find a settlement safe from other warring tribes. This tribe was known as the Xochimilcos (pronounced so-chi-mil-cos). They were inhabitants of the Central Valley of Mexico, a huge valley completely surrounded by volcanic mountains.

After fighting with neighboring tribes, they decided to retreat to some islands on the shallow lakes of present day Mexico City, which have long since been drained. These lakes were caused by constant flooding of mountain runoff from rain and springs. There, on these islands, in a land locked basin, they had to create a system of land reclamation. This land reclamation and subsequent agriculture is known as the Chinampas system.

Chinampas farming is the most intensive and productive methods of farming that has ever been devised! It provided the Aztecs with land to live on and their first surplus of food they have ever known. This new wealth enabled them to quickly build standing armies and soon conquer all of Central Mexico, supported completely by Chinampas farming. Misinterpreted as the “Floating Gardens”, Chinampas are actually long narrow strips of land surrounded by water, like a peninsula. These strips of land were separated by drainage canals.

From the depths of these canals, the peaty sediment and mountain runoff were scooped up and piled on top of the land strips, making them higher than the flooding waters. They would weave branches and live willow trees to anchor the rich, mucky soil in place. This created a moist planting surface. Every year another layer of fertile mud would be dug up and spread on top of the existing chinampa.

The most essential element in chinampas farming is the seedling nursery technique. Here, the original soil blocks were created. At one end of the peninsula, the thick mud was spread over a wattle of weeds. After several days the muck would be hard dry enough to cut into little rectangular blocks called chapines. Then, the chinampero, or farmer, makes a little hole with his finger or a stick in each chapine, drops the seed in the hole and covers with a little manure. They were watered in the dry season and covered with reeds in the winter to protect from frosts. The seedling is then transplanted in the chinampa, which was leveled and hoed using a digging stick, or coa. Finally, it was covered with a thick layer of fertile canal mud.

The Xochimilcos raised corn, beans, chili peppers, tomatoes, and amaranth. Flowers were also grown with this method. A dozen varieties of dahlias, and marigolds were grown for the altars of the pagan gods. Later, after the Spanish conquered the Aztecs, they continued to grow the native varieties and European crops like, carrots, lettuce, cabbage, beets, radishes, onions, carnations, roses, and lilies.



Most recently developed in Holland, the potting blocker, is now made of a zinc coated prefabricated steel. They have been in use there for about 100 years. Europeans have been using potting blockers for market gardening for decades.

According to the **Museum of Gardening at Harlow Carr London (UK)**: *"Before 1939 large numbers of plants were raised annually in clay pots. These commonplace earthenware items required considerable fuel to fire them, and production ceased during the war. The solution was to make the growing medium self supporting.*

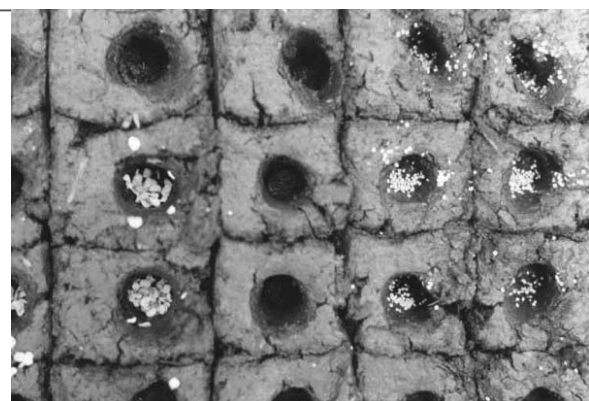
In use, the mould is loosely filled with compost, the compactor is brought firmly down with two hands, and finally mould and compactor are raised together. The block is then slid out. The compactor leaves a central depression which is filled with a pinch of loose compost, and in this the seed is sown. The blocks are 7cm across, and the hexagonal shape allows close-packing on glasshouse bench or floor."

What are the disadvantages?

The soil block gardening method needs attention. Although this may not be seen as a disadvantage to some, others may find it new to their gardening style. It is precisely why the soil blocks work so well, that they need extra attention paid to their needs. Rapid growth in the block requires constant monitoring of the watering. And, if growth is to be expected, then so does the proper timing of the "potting on" or transplanting.

It is a horticultural fact that plants grow the fastest when they are given just a little more room to grow than their previous space. This requires precise timing as to when to transplant. Daily routines must be established to check for warmth, light, growth, water and weather. The very nature of soil block gardening means starting earlier in the spring or late winter.

Paying close attention to weather to watch for "windows of opportunity" are part of the game of transplanting.



How does a soil blocker work?

A soil blocker makes little compressed cubes of free standing potting soil. First, a large tub is filled about one-third of the way with the appropriate type of potting soil, known as the “blocking mix”. It is moistened to the consistency of wet oatmeal, known as the “slur”. Stirred well, it is left to soak up all the water for about one to three hours. This ensures that all the fibers in the mix are moist enough to bind or “knit” together, and the consistency holds the block upright.



This is very different from using traditional dry filled plastic containers! You should be able to pick up a handful of slur and squeeze out a few drops of water. Then, it is perfect. Mound up the slur in the center, like a little hill. Now, one comes up to the tub with a blocker in two hands (or one hand with the smallest blocker) and, making sure the mound is three times the height of the blocker being used. Diving straight in and parallel to the ground the blocker is thrust in the mud and twisted back and forth. When the blocker hits the bottom of the tub, tilt back slightly to release the suction from the bottom and twist all at the same time and do it again. By the second or third thrust you should see some water oozing out the top. This is known as “charging” the block. You can’t over pack the blocker.

Once it is compacted, it must be “discharged”. You can set them on pieces of wood, concrete slabs or some hand made wooden crates. There sits a perfectly square molded soil block complete with an indented seed hole. They are strong, sturdy, a pot without any sides. Pick them up and move them around.

Simply brilliant!

Why are they so great?

Less space, more soil, no pots, better growth.....

Scientific studies have shown soil blocks to perform much better when transplanted than traditional methods like plastic pots, plugs, peat pots, compressed peat pots, or the Japanese paper pot. And, they sure are a lot cheaper than rockwool cubes!

Researchers have also proved that plant roots grow better in cubes rather than tapered pyramid plugs. It’s all about the transplanting, and plants grown in soil blocks never know they aren’t already growing where they’re supposed to live! Why? The walls of the potting block are actually the air that surrounds it. So, when the root gets close to the air it turns backward and focuses its growth in the centre of the cube. This eliminates transplant shock!



Plastic pots, on the other hand, encourage root circling and root rot; giving the plant a false impression of life! Transplanting into garden soil will shock the plant and they tend to wilt and become stunted. But the blocks remain ready for explosive growth as the roots move out of the block into the garden soil at it's own pace, adjusting to the new air to moisture ratio. And, they're much sturdier than other transplants. The root ball is heavy and concentrated in the centre of the block, so it is less likely to be affected by wind.

It can also be handled easier. Pick it up and toss it to your neighbour. You'll shock them, not the plant! They don't fall apart. You aren't hacking away at their roots to get them out of the pot, you're not "pricking" them out of tightly knit flats with intertwined roots. Roots are their water and nutrient uptake system. You'll feel a lot better if you don't see roots!

The investment in potting blockers pays dividends immediately, and they free up so much extra time by eliminating the cleanup and sterilization process of plastic pots and plugs. There is also no more purchasing of plastic pots, trays, plugs, plugging machines, peat pots, etc. It beats the constant price hike in petroleum by-products!

And, best of all, for large-scale growers, it eliminates the huge mounds of broken and deteriorated plastic pots and trays. This makes it an excellent environmental product to use. There are no breakable parts and they last for decades without any maintenance. Just keep them clean with a little rinse off. This will ensure trouble-free use. Blockers are also highly regarded in Organic farming as the standard for quality.

Potting blocks are also an efficient use of space. Potting blocks allow more plants per square metre of space than any round pot. And they won't get knocked over. You can build custom wooden trays that allow you to stack trays of blocks on top of each other. Because of it's cubic, rather than tapered sides, potting blocks contain 2-3 times as much volume of soil than a plastic pot of the same top dimension.

What kind of potting soil should I use?

The soil in which blocks grow must be specially formulated or at least specifically blended. This medium is known as "Blocking Mix", or "Blocking Soil". It should be noted that when you make your own with garden soil and compost, you will be making a "Blocking Soil".

If you were to make your own without compost and soils, you would be making "Blocking Mix". "Potting soil" may contain compost, while "potting mix" is usually inert, meaning, without biological activity (breakdown), and is usually sterilized and very lightweight.

While there may be many commercial varieties of potting soil available, mixing your own makes the very best.

The reason being is that most potting soils do not contain real "soil". Good garden soil from your own carefully tended plot is a key component to the overall health of your transplants. Here, in your soil, lies secret ingredients: bacteria, fungi, nematodes, protozoa, beneficial micro-organisms, are known as the "good guys" and are actually protecting your garden from the 1% "bad guys".

Much like the Chinampas of Mexico, your blocks should be made from some of your own soil. But, blocking soil also needs extra fibre, like coir, to ensure it won't fall apart when watered to a sticky paste, or slur. Coir or kenaf add great water holding capabilities, since blocks have no pot to sit in and drink freely. Blocks also require good air porosity and drainage. This is where Perlite, asbestos-free vermiculite, and sand come to play in the mud. And, of course, compost. Blocks need compost. The miracle maker, the fertility factory, the nutrient warehouse, compost. Good compost is well decomposed and preferably comes from your own pile.

Homemade mixes aside, there are commercially available potting soils that work just fine. Others may be available, so try them all out if you don't want to mix your own. If you're an Organic grower, make sure to check the ingredients and compare with OMRI (Organic Material Review Institute), there are companies out there that claim to be "organic", but actually contain non-organic materials.

One of the simplest mixes is:

1/3 mature compost or leaf mold, screened

1/3 garden topsoil

1/3 sharp sand

Mixed with coir or a similar material. However, the most locally produced option would be to use vermi-compost (compost made with the help of worms)

Well, by now your soil blocks are probably busting out at the seams with all your favourite spring starts. You will undoubtedly be wondering how to assure the success of the seedling, after watching it sprout and grow so vigorously in the soil block.

We'll cover some crucial basics to transplanting soil blocks in the garden outdoors.



FIRST: the best success comes from hardening off the seedlings. That means, get your pampered windowsill or greenhouse seedlings accustomed to the variable, drastic, and changeable outside conditions. It begins by taking your flats or trays outside on a sunny day with little to no wind which will dehydrate the little guys. Bask them in the sun for about 2 hours, and then return to the comforts of the indoors. The next day, they will spend 3 hours, the next day, four. Keep doing this until they are successfully "hardened" by the sun, breeze, temperature, and changing elements.

This process should take a week, sooner if weather conditions are perfect, longer if the weather has been inclement. Some may say that this is an incredible amount of labour or work. They may be right, but all the plants grow, with no losses! What is sown in the block, grows up and is harvested out of the field. No thinning, no lapse in germination, no waiting for the right conditions in the garden, no transplant shock, and no stunting of growth. So, in the end, it will be the same amount of work, but the soil block will have the larger volume of produce harvested.

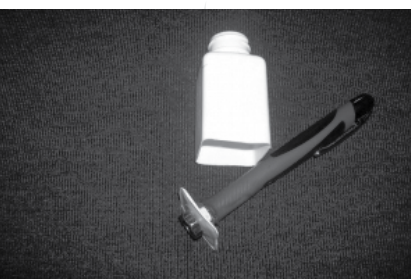
SECOND: the key to success is soil block moisture. They should be wet before being planted. The success of soil blocks depends more on their moisture level than the outside garden. After a good night's saturated soaking, they'll be ready for transplanting the next night. Or, if they're really growing fast, soak a couple of hours before transplanting at night. Always transplant at night for best results because they'll use the whole night to get acquainted with their new home. Water only when the weather has been dry for a couple days after transplanting, and gauge the needs of your plants accordingly. With no transplant shock, they'll be growing very fast again.

THIRD: the third success point is soil block depth and coverage. Plant your soil block deep. Deep enough so the entire block can be covered with soil. Firm all around the block to squeeze out any air pockets, which can dry out a block faster than cut flowers in the desert sun. Always cover any bare stems right up to the first true leaves, even burying the seed leaf. That may surprise you, but you must trust me, **PLANT DEEP.**

FINALLY: the best advice is timing. Use your gut feelings to predict the optimal time to transplant in the garden. If the weather turns sour, keep them sheltered for awhile before submitting them to the elements. If conditions are perfect and will remain so, try getting them out sooner than the recommended week of hardening off. Perfect conditions mean: moist air or humidity, a really good rain a few days ago, or a scheduled rain after transplanting, partly cloudy, partly sunny, (does anyone know the difference between the two?) no wind, barely a breeze, and believe it or not, 2 days before the New Moon, as this will pull their roots down and stimulate root growth, something to do with the tides and all that influence.

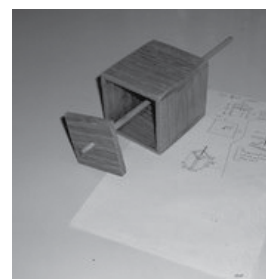
Making your own soil block machine

Making your own soil blocker is not difficult - in fact, anything that allows you to make a compressed block of soil will do the trick! So it need not be a fussy process or highly technical system.



(Left) What you're looking at is a pill bottle with the bottom cut out. The bottom was trimmed to fit inside the bottle and inserted between two nuts and threaded onto a bolt. The barrel of this ink pen, it served the purpose of a plunger.

(Right) this is a simple, homemade wooden blocker.



(Below) Different types of soil blockers and their use.



Two simple versions that you can make yourself follow here, but many others are possible.

(IZWA comment: Please note that PVC and resins are harmful to the environment, and if the PVC is burnt, it is very harmful to all life. If you can find metal pipes instead, that would be preferable - please be very careful when using tools and machinery)

STEP 1:

These are the parts and tools you will need:

- scrap PVC pipe
- 15mm wood dowel
- circle cutter for use in drill press only, same size so as to cut a circle that will fit in the pipe.
- 15mm drill bit
- carpet tape
- ruler
- hand saw - not shown
- oil (can be linseed oil or similar)
- 18mm wood screws
- 18mm thick wood scrap (I used Pine)
- wax (candle)

STEP 2: - Cut out disks

Cut out 3 disks, each a bit smaller than the inside diameter of the pipe. Cut 1 first to check fit. Remember, the wood will swell a little when wet. It will swell even after sealing it. Don't make it too tight. The top disk can fit tightly in the pipe top. This piece won't move when installed. The plunger needs to fit loose just so that it can push the soil block out without too much effort.

STEP 2: - Drill holes

Layout for an 18mm hole. Use carpet tape to secure the disk to the drill press top. Line up your marks and drill. You need to get perfectly centred. There is no centre punch to guide, so this is why you need to carefully lay out your 18mm hole on cross hairs and boundaries on top. Drill 2 disks all the way through. Drill the disk top handle about 6mm deep only.

STEP 3: - Dry fit and assemble

- Cut 18mm dowel to 150mm long
- Glue in 18mm dowel to the handle disk
- Cut the PVC pipe to 90mm long.
- Put top disk in flush with the top. Drive a screw into opposite sides to secure.
- Seal with linseed oil
- Put handle rod assembly into hole
- Attach plunger disk flush with bottom of rod for a solid soil block. Secure disk to rod with a screw.
- Put some candle wax on the 50mm plunger disk (if tight) to help smooth the stroke



STEP 4:

- Finished Assembly



Another design of a homemade soil blocker, with a completed soil block. (Plans on how to make it >)

Please see the following table for the components you will need to create this soil blocker.

PART	Description	Quantity
A	30mm PVC CAP	1
B	6mm X 150mm threaded rod	1
C	6mm nut	2
D	24mm wood screw	1
E	50mm X 110mm PVC PIPE	1
F	50mm PVC CAP	1
G	9mm x 150mm Hollow Tube	1
H	18mm Compression Spring	1
I	6mm Flat washer	2
J	Handle for top of 6mm threaded rod (see instructions #4)	
K	Filler for 30mm PVC cap ** See Special Note in instructions	
Tool	Drill with 6mm and 12mm bits Bucket or Bowl (container) to mix soilless slurry Water to make soilless slurry Table top, plate or block of wood to press soil block onto	

Making the Plunger

STEP 1:

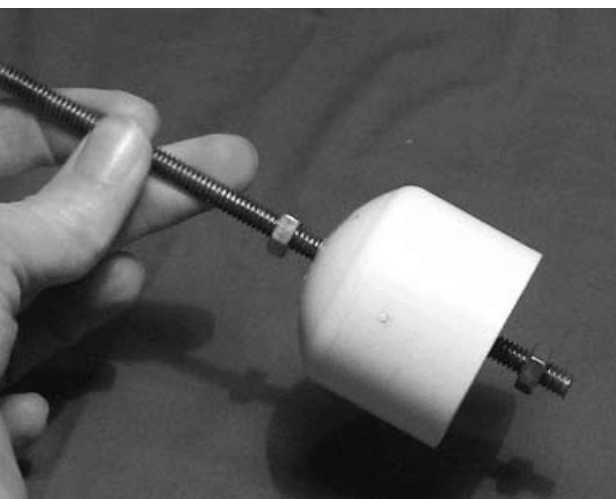
Take part A drill a 6mm hole in top center.
This will allow the insertion of part B.



STEP 2:

Thread or insert part B into A, then thread part C about 12mm onto threaded rod, pull threaded rod through A so nut is flush with inside cup. Thread second C onto B and secure flush to A, so threaded rod is secured onto A. (Assembly #1) set aside.
(see pic.) **see FILLER info



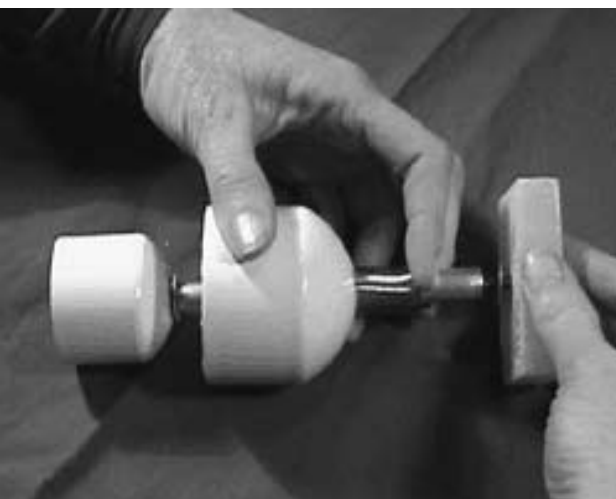


STEP 3:

Take part E drill a 12mm hole large enough to slip part G through hole. (Assembly #2) set aside. (see pic.)

STEP 4:

Take part J (handle). This can be made out of anything, plastic, wood, etc. Anything that will give you comfort when pushing on the plunger. The one in this example is made out of a recycled piece of plastic, with a 6mm hole drilled into it to received B as detailed in images and instruction #5.



STEP 5:

Take Assembly #1 insert into Assembly #2 through the bottom of G. Slip parts I (flat washer) and part H (spring) over G, which is sticking out the top part of E. Push H down enough to place second I on the end of B, which is sticking out of G, then attach J to hold all parts in place (see pic.)



STEP 6:

After A has been filled, take part D (24mm wood screw) and screw into centre of filler to create a divot you will need to plant your seed. If you opt not to do this and want to put a hole in the soil cell after forming the soil cell, you stand a good chance of breaking down the walls of the soil cell and you may have to remake again. Which gets easier and easier, once you get the rhythm.



Special Note:

It is possible to tap all the drilled holes to have threads so you could screw everything together.

If you do not have access to a tap, some type of water resistant durable glue will help hold things in place.

****Filler for Part A** - in order to have a flat surface on the top of the soil cell, the 30mm cap needs to be filled with something hard. For my project I chose Resin, which lends itself perfectly to making a hard surface that is easy to clean.

In the centre of the resin is where I inserted the wood screw, which gives the soil cell a divot in which to place a seed. The filler will ultimately secure C on to the end of B, which is inside the bowl of A. Make sure the measurements are where you want them **BEFORE** filling.

If G is too snug, make the hole in E a little larger, but not so it is sloppy. Over time it will become less snug.

Please be careful. Working with tools can be dangerous.

Many people bought soil blockers through the years, and then, stopped using them. There are numerous complaints as to why they won't bother with them again. This has come about due to the lack of authentic information at the time of purchase, and misguided information from garden forums on the web. Results from your soil blocker should always be excellent.

Consider the following important points:

10

You don't wet the potting soil enough, or you water it down too much. You are striving for the consistency of oatmeal. You would want to pick up a ball of mud and sling it on a wall and there it would stick. You want your blocking mix to be wet, yet one that will only drip when well squeezed with your hands. You are looking for stiff wet mix, yet you won't see any water puddling. The soil should easily stack up in your bin. Keep churning it, and adding water to wet, or more potting soil to dry.

9

You don't dip your soil blocker in water after every discharge. Dipping is essential to wetting the machine and allowing the next round of blocks to eject smoothly.

8

You don't screen your potting/blocking soil with a 6mm screen. This is essential, as particles larger than 6mm will clog the simple moving parts in your blocker. This causes the blocker to eject a crumbly erratic block.

7

You don't charge, or pack your blockers with enough soil. Don't be afraid to pack that soil in the mould. How else is it supposed to hold up to watering and root growth without a pot to contain the plant? You cannot overcharge a soil blocker. This is why it was created: To hold 3-4 times more soil than a loose filled pot of the same dimensions. The roots will penetrate the soil easily, provided you made your own potting soil.

6

You don't cover your seeds by sifting more potting soil over the top. Unless your seeds require light to germinate, always cover with sifted potting soil to anchor your seed in the block and mimic natural conditions, like moisture and darkness.

5

You do not keep the block warm in a warm enough spot. In nature, the soil on the ground serves as a heat sink or bank and can retain that constant temperature. Not so in blocks and pots. You must provide the minimum heat requirements, which can be that the blocks are indoors, or that they are in a greenhouse.

4

You do not make perfect blocks. Be prepared to practice a few times, if this is new to you and allow some trial runs.

3

You don't mist your blocks. How else are you supposed to deliver oxygen to your roots unless you "mist" them and oxygenate the water as you water your blocks? Mist mixes with air and light as it is soaking your blocks. Mist is easy to find and is the life blood of your plant roots. If all you have is a watering can, at least fill it up using a squeeze trigger nozzle and really, really agitate the water so it gets real foamy and bubbly. This aerates the water and delivers oxygen to your roots.

2

You don't water them enough. After your seeds sprout, they'll need water three times a day if you use a peat moss based soil. Less, if it has coconut peat, and even less if it has water absorbing crystals in it. That's why it's important to know your ingredients. Bottom watering is helpful, but are you aerating your water with an air bubbler? Remember, you must actively aerate your water for your blocks, unless they're planted at the edge of a rushing stream!

1

You don't use the right potting soil. You must make your own and in the correct proportions. At very least, you have to experiment with store bought brands.

Potting soil and mixes were never meant to be used in compression machines. They were not formulated to allow water to penetrate while being compressed. They were not mixed with the right volume of peat to compost. They may not have enough aerator and moisture retaining ingredients like perlite, diatomite rock, or pumice. Or, the particles are too big. Or, the compost was made with forest by-products. Or, there was no long term fertilizer. Many people believe that all potting soils are the same and should work with their new blocker. All potting soils are not the same, and must be tested in order to see if they're compatible with the soil block machine.

Some say that mixing their own is too much work, or they can't find the right ingredients. You simply have to mix your own if you want real great results.

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