No-Water(ing) Greenhouse Growing

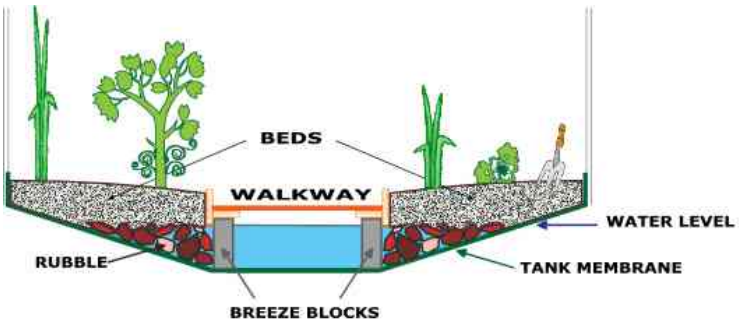
Food growing in Scotland's cool climate is always a challenge, especially living at 800 feet (240mtrs). Journeys south of the border in spring and autumn seem like time travelling. You can almost see the waves of blossom and leaf fall sweeping slowly up and down the country. I was therefore intrigued by discoveries made by archaeologists reconstructing how the ancient Inca farmed 12,000 feet up in the much more inhospitable region around Lake Titicaca.

They uncovered networks of metre-deep water filled channels between beds raised high enough above water level to let the roots breathe. The numerous interconnecting channels were home to various edible fish, and extended over thousands of hectares, creating a micro-climate that protected the crops from seasonal drought by soaking into the beds, and the year round frost danger by releasing daytime heat stored in the water. Aquatic plants grew abundantly in the channels, and fish manure settled as silt. Each year they would scoop plants and silt back onto the beds.

Showing a rare practical interest in his subject, Erickson encouraged the local Quechua to try these techniques for growing their own crops, with the stunning result that yields immediately increased *tenfold*. Impressed, local farmers started re-adopting the more sophisticated ways of their ancestor's.

These days we have polytunnels and greenhouses, making it possible to enjoy fruit & veg that would otherwise be impossible so far North, but they do have one major drawback – no rain. Now in Scotland that comes particularly hard as you stand, hosepipe in hand, deafened by the thunderous roar of yet another downpour on the polythene just above your head. Something not joined up here I'm thinking, isn't this a sin in the Permaculture bible? Piped water additives are another concern, as is the difficulty in going away for extended periods. Unless you can arrange for someone to do the watering for you, two or three weeks away in the height of summer is often unthinkable.

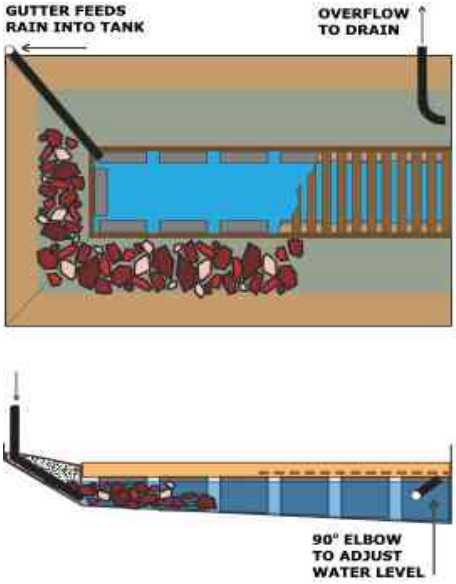
So I started musing, how could I get the rain back inside? Catching it as it comes off the roof is the first issue. There are I believe self-adhesive gutters you can attach to a polytunnel directly, though I have no experience of them. A greenhouse is normally simple to rig up with gutters. As I had already built a guttered polytunnel (described in PM xx?), I thought here was the chance to give it a go. My partner Eilidh had previously experimented with burying polythene underneath a bed to help it hold water longer on her allotment. Initially appalled at the thought of sour soil and drowned roots, I was surprised that it seemed to help quite a bit without injuring the plants. Still needed a lot of water hauling to fill, so the prime requirement for the mark II was a self-filling mechanism!



All these various threads came together in the experiment illustrated here, which is effectively a large sunken bathtub with the sky tap left running. Rain comes in one end, soaks sideways under the beds and any overflow runs out the far end. Rather than use some form of sprinkler or seep hose system, which would probably need a powered pump to work well, I remembered the Inca and thought I'd stick with gravity and try letting water come up from below instead. As it turned out, this created an extremely dry soil surface, which inhibits slugs and weed germination. A dryer atmosphere is also less conducive to the many moulds and fungi which thrive in the typically muggy environment under cover. A critical part of this system is having sufficient depth of soil (20cm) to ensure the plant's roots can make their own choices between warmth, air and water. They can smell it beneath them and reach down into the ever damper earth until their thirst is satisfied. Tomatoes in particular

headed straight for the borders by the walkway, closest to the free water, and spread many feet along it.

I began by digging out the shape of the tank, in the process unearthing plenty of rocks that would later form the rubble infill. You could well use a more flat bottomed tank, or indeed build the whole thing up above ground, I chose sloping sides to test the widest possible range of soil moisture. I could have used a perfect membrane to ensure a completely watertight tank, but I'd always been taken by the way worms love to party in old polythene lying about in the garden, guess it's warm and wet between the layers, and I had a stack of the damn stuff. Odd shapes, odd rips and punctures – not pretty, and not really much use for anything else. Several layers compressed together under the weight of the soil and water would leak, but very slowly, and the worms and beasties could wriggle their way in if they had a mind to, particularly as it would be the warmest place around. So first a layer of skipped carpet on the bottom to avoid further punctures, then three layers of the poly covering the whole area of the greenhouse and stapled to a single plank edging running around the perimeter at ground level.



Since nothing would grow underneath the walkway, it seemed sensible to store the bulk of the water there, and while I was at it try and trap some warmth by making it slatted so the sun could shine in and heat it up. This light and warmth has encouraged mosses and algae to grow in the dappled shade, and attracted spiders and toads. In time maybe a whole eco sub-system may evolve under here! Stored heat is more erratic, as fresh rain flushes out the warmed water, usually of course on cooler days, but it does mean the reservoir never gets stagnant.

I laid two lines of reclaimed concrete blocks directly on the poly with approx. 10cm gaps (or try a honeycomb of bricks), as level as I could to carry the central walkway, and hold back the soil. Resting on top of these are two 75mm x 50mm battens, with the edging boards and walkway slats nailed to them. The downpipe from the gutter runs under the beds and emerges between the blocks under the top end of the walkway. The outlet was a standard 150mm drain pipe which empties into the rushes nearby. I fitted a 90° elbow which is easily rotated to control the high water level inside. To keep the walkway dry I set it about 1cm below the tops of the concrete blocks. Outside the blocks is filled with rocks, any coarse rubble would do, to roughly the expected water level to let the water freely percolate under the beds, and avoid a completely waterlogged base to the soil which might turn anaerobic or leach nutrients and minerals.

I collected many fine molehills from the surrounding grazing, mixed in compost, sheep manure and basalt rock dust. This soil mix was piled directly on top of the rubble, in

contact with the water at its base, approximately 20 cm deep, and slopes slightly from the edges to the centre, 'cos it looks nice. In dry periods the water under the walkway almost disappears as it is drawn up by the plants and evaporation, yet although the surface is a dusty desert, dabbling your fingers in the warm topsoil showed the darker, damp soil beginning no more than 2 cm down in even the hottest periods, bearing in mind this *is* Scotland.

I wanted to see what this system could do, so my heartless procedure was to water in individual seeds and transplants when first introduced, and once or twice again in the next few days if they looked like they needed it. After that they were on their own. Apart from this lulling into a false sense of security, and some minor weeding, this entire greenhouse was **un-watered by human hand** from April right through to the following spring, and as you can see from the photos most everything thrived. The garlic was the only total failure, several bulbs being planted along the outside edge high above the shallow (South) end, where it was just too hot and dry, even for this sun-lover. Cacti would do well here!

Peas, broad and french beans, courgettes, calabrese, several sorts of tomatoes, basil, leeks, coriander, pumpkin, cauliflower, lettuce, kale, red mustard, cabbage, walking onions, sorrel, nettle, grass and creeping buttercup, all did well. Obviously a serious grower would use such a system to ease their workload rather than replace it. If I had watered during the driest periods, pinched out trusses etc., given them all more love and less apologies I'm sure the yields would have been greater, but as a result of total and absolute neglect, I think they're pretty encouraging. I had thought the central water channel might encourage slugs, but damage was surprisingly slight, with mice proving a greater threat in the midst of a hard winter, climbing the brassica stalks and nibbling out the hearts, the wee souls. The pumpkins probably did best, with half a dozen double-fist sized specimens as well as the champion illustrated.

I haven't run this experiment long enough to tell the long-term effect on soil condition, but it is not really very different from growing in pots or on benching. As long as care is taken to feed and refresh the soil periodically, I don't see why it should be any less successful. This system is not the answer to everyone's prayers, but as a way of lessening the need for visits to a distant allotment, water bills, the impact of hosepipe bans and fretting about your darlings while you're away, then less time spent putting the rain back on the ground may be worth the slight trouble involved in construction, or perhaps act as a springboard for other solutions.

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