Earthbag / Burlapcrete Raised Garden Beds

Objectives:

- Build a series of raised garden beds using earthbag, burlapcrete (hessiancrete) and hugelkultur technologies.

Earthbags? Hessiancrete?

Earthbags (sometimes called sandbags) have long been used, particularly by the military, for creating strong, protective barriers, or for flood control. The same reasons that make them useful for these applications carry over to creating housing – and garden beds. Since the walls are so substantial, they resist all kinds of severe weather and also stand up to natural calamities such as earthquakes and floods. Earth bag building is essentially rammed earth in a fabric form. They can be erected simply and quickly with readily available components, for very little money.

Burlapcrete is basically loose-weave burlap (hessian), soaked in a modified cement. The burlap is used as a form and reinforcing material for the cement.

Process

1. The bags are filled to between 2 thirds and 3 quarters full.
2. The ends are carefully folded over (they can be stitched down, although we aren't doing that here).
3. The bags are laid end to end to form a wall, and gently tamped into place.
4. Two rows of barbed wire are laid on top of the row of bags, to help anchor the rows together.
5. A second row of bags is laid over the first (sandwiching the barbed wire) in a running bond pattern, and tamped into place.
6. The entire garden bed wall is covered with burlapcrete.
7. Once the burlapcrete has dried fully, we put a layer of wood (prunings, dead wood, etc.) into the bed, and cover it with a layer of straw or grasses.
8. Finally, we cover the wood and straw with topsoil. If we want to, we can inoculate the bed with beneficial microorganisms using a compost tea, whey, or commercially available micorhyzza.

What Kind of Bag to Use for Earthbag Building?

Standard (22.5 Kg) woven polypropylene rice or grain sacks are recommended. You can also use hessian (burlap) sacks if you're going to use a cement or lime stabilised fill mixture.

Polypropylene bags come in gusseted and non-gusseted styles. Both are appropriate for earthbag building; the gusseted ones are slightly better because the base of the bag doesn't produce pointed protrusions that need to be hammered back into the wall to make it smoother before applying a plaster.

- We sourced our bags from **Bundy Bags** (http://www.bundybag.com/), who sell seconds and polypropylene sandbags at $40 per 100 bags.

Fill Material

The bags can be filled with whatever non-organic material you have available. Volcanic rock (scoria) has been used in some areas because it is lightweight and highly insulating. At least one successful earthbag building has been made using bags filled with a mix of white beach sand and crushed coral. The mix should not contain more than 30% heavy clay soil to 70% sandier soil. If you use higher percentages of heavy clay, there may be issues with moisture based expansion and contraction.

- We are using the local soil, which is mostly laterite gravel. There is also a small percentage of clay in there; it's pretty standard Perth hills soil.

Soil stabilization is rarely needed in earthbag construction. Under some circumstances it might be advised in parts of lintels or arches to make them more rigid, or if the fill material is too loose, such as with very fine sand, that doesn't want to compact into a solid.

There's no need to tamp the bags excessively, just tamp until they're solid. For building a house, the recommended time is one minute per bag, maybe two minutes if you're slow and tired. There's a change in tone when they become solidly compacted. For our little wall, we just stomp them until they feel solid.

Barbed Wire

Add barbed wire: use two strands of 4-point barbed wire in-between each course of bags. The wire should be spaced about 10 cm in from each side of the bags. It can be temporarily weighted into place with bricks or stones until covered with the next course of bags.

The barbed wire has two functions: 1) it helps lock the bags together and 2) it helps resist any tendency for the wall to expand outward with the weight from above. This wire should be placed between every course as the wall goes up.

Rendering

This is where the burlapcrete, or hessiancrete, comes in.

Earthbags have to be rendered. The bags are made of polypropylene, which is almost indestructible in the dark, but degrades in UV light. You can use basically any render mix, including earthen renders, papercrete, hempcrete, lime render, cement stucco, etc. A cement stucco or cement stabilised lime or earthen render is better for domes and other structures with minimal or no protection from rain, and for structures in humid climates.

Hessiancrete is concrete laid using hessian fabric (otherwise known as burlap, or sack cloth) as a substrate and support. Basically the same idea as ferrocement, but instead of using chicken wire or rebar to strengthen the concrete we're using hessian cloth. It's cheaper, easier to work with (more flexible), and more environmentally friendly.

There's a bit of information available online about this idea, mostly in forum posts. Notably, John Annesly's 2004 blog post on the subject is very thorough, and suggests various concrete mixes as well as offering some very useful general advice.

What we'll be doing is mixing up a standard rich cement mix (1 part portland cement to 3 parts plasterers' sand), but mixed to a much wetter slurry than normal. The consistency should be more like runny yoghurt than thick, creamy cement.

We will dip lengths of wet hessian into the mix, and drape them over the filled and placed earthbag walls.

- We sourced our hessian from **Colquhoun's Fremantle Bag Company** (http://www.colquhouns.com.au), who sell rolls at $2.65/m ($132 for a 50m roll).

Finishing Touches

To finish off the garden beds, we have to fill them with soil and get them ready for planting. To do that, we'll be using hugelkultur to improve the water retention and fertility of the soil.

Hugelkultur is the practice of composting large woody material to create a raised garden bed. It is a way of dealing with excess amounts of woody garden wastes, for example prunings, hedge clippings, brassica stems, etc.

Once the hessiancrete is completely dry, we'll partially fill the garden beds with prunings and dead wood, complete with local wood-decomposing fungi. Then we'll cover the wood with straw and grass clippings.

After that, we'll cover the wood and straw with the topsoil from the area (pushed to the side before we started building), and inoculate it with worm castings, whey (for the minerals and beneficial bacteria), and micorhyzza.

We'll also dig in some compost before we plant our seedlings. And mulch them heavily when we plant.