Sustainable Approaches to Food Production

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ABSTRACT

Permaculture is a system of ecological design that aims to create more sustainable communities: its principles reinforce to participants understanding patterns of nature, learning food production, managing water catchment and storage, utilizing renewable energy, and building communities. A permaculture system is the exemplary sustainable approach to food production systems that the Campus Garden aims to bring to the University at Buffalo. Using the framework "Grow better, not bigger," the ultimate goal of this research is to double the amount of food production to forty-pounds, in the same 20'x20' plot of the UB Campus Garden. To advance the Garden's vision and further emphasize the importance of sustainability, it is our goal to explore different gardening techniques for implementation during the growing season. We aim to educate individuals on gardening techniques, prove that implementation of these techniques is plausible at various sites, and expand the understanding of the importance of food production.

COMMUNITY ENGAGEMENT

To better engage the UB community it was important to gather baseline data of the UB community's understanding of the Campus Garden. The group distributed an electronic survey to the UB community over a period of four weeks, questioning individual knowledge of the work at the campus garden. We obtained the following results:

Of **745** Respondents-

50% Have not heard of and did not know location

97% Have not volunteered

86% Did not know CDS uses herbs from the Garden

75% Agreed it is important UB improve Sustainability

76% Agreed is it important to know Source of Food

We also work with many partners around campus:

REFERENCES

[1] "Edible Forest Gardens."

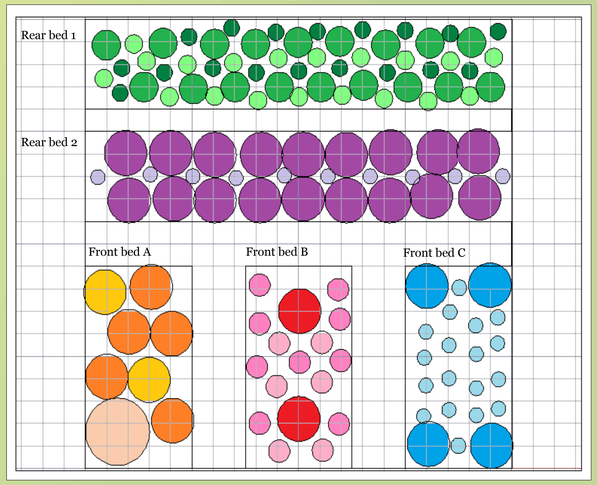
[2] Tricia Chaves, "Companion Plants for Raspberries." (2015). SFGate: Home Guides.

[3] Joan S. Bolton, "Succulents." (2013). Santa Barbara Garden Design Blog.

[4] Geoff Hamilton, "Organic Gardening." (2011). DK Publishing

PERMACULTURE TECHNIQUES

Application of permaculture principles allows for maximum growth potential in the 20' x 20' garden plot. Using aspects of a permaculture system we begin to create a more sustainable and prosperous food system. The main permaculture techniques being tested are companion planting and guild creation. Plant guilds are a beneficial grouping of plants that support each other in different ways. Some of the ways the plants support each other are exchange of nutrients, physical buttresses, and by promoting diversification [1]. Plant guilds are created by using companion plants. Companion plants are plants that can be grown together in the same area that will allow both plants to flourish in ways they otherwise would not if planted by themselves. In our research, five different plant guilds are created to evaluate the principles of permaculture.



Rear bed 1 contains sea kale, walking onions, and collard greens. All three have different root structures allowing for maximum use of the soil. Each species has insect repellent properties. Seal kale is a mulch-maker and walking onion are a fungicide. [1]

Rear bed 2 contains asparagus and comfrey. Both have tap roots but at different lengths utilize nutrients from various layers of the soil. Asparagus is a nematocide and comfrey acts as a chemical barrier and mulch-maker. [1]

Front bed A contains agave, sage, and a butterfly bush. Sage and agave grow well in low water conditions. [3] The butterfly bush will attract pollinating insects which will be useful for all plants on site.

Front bed B contains rhubarb, jack in the pulpit, and lily of the valley. All are medicinal plants. Rhubarb brings nutrients up from the bottom layers of the soil; lily of the valley acts as groundcover; jack in the pulpit adds biomass. [1]

Front bed C contains raspberries and garlic. Raspberries benefit from garlic because it accumulates sulfur, acts as a fungicide and pest fighter. Raspberries require much space between plants which allows for more growth room. [2]

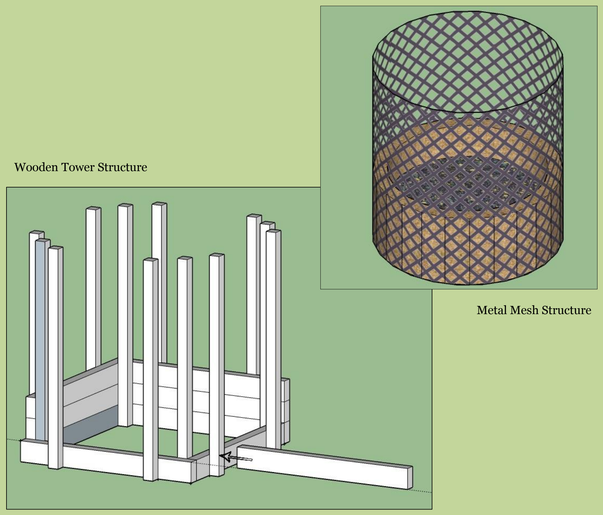
VERTICAL GARDENING

The use of vertical gardening maximizes the given space to produce a greater amount of food with better efficiency and ease of harvest. The technique this project focuses on is through different variations of potato towers. Displayed are two designs; using these we will compare the potato production in pounds of yield at the end of the growing season.

Potatoes planted straight into the ground are difficult to harvest as they require a large amount of space with little production. Potato towers bring the process above ground for ease of harvest and a maximum production/space ratio. As the potatoes grows, the roots will show above ground and will need continuous soil addition until plants reach the top of the tower.

The first method is a wooden tower that is reusable. A wooden frame is built with an overall dimension of 3 x 3 x 3.5 feet. This gives space between each potato seed and a height that will accommodate total potato production. Conventional potato towers will screw wooden boards to the frame as the roots grow upward. For a more sustainable approach, our potato tower will allow a wooden board to slide in and not be permanently attached to the frame. This allows easier dismantling for harvest and less damage to the frame.

The second method is a wire-frame potato tower. This method is less expensive and requires less experience with woodwork. This uses metal fencing to create a cylinder with a 4 foot base and is 4 feet high. This gives stability to the fencing and space for growth. To prevent the soil from falling through, hay will be placed as a barrier around the cylinder. The soil layering process is the same as the prior tower.



Wooden Tower Structure

Metal Mesh Structure

CONTAINER GARDENING

Container gardening allows for an increase in productivity while optimizing the available planting space. This method focuses on growing annual vegetables in various containers positioned around the perimeter of the garden plot, to analyze the effects of companion planting techniques and how different container types effect growth. Utilizing two types of containers, wooden-rectangular and plastic-round, we will plant two groupings of plant species. The first plant combination includes peppers, tomatoes, onions, and geraniums. The second plant combination includes cucumbers, eggplants, lettuce and marigolds. Keeping the types of plants constant on two sides allows for evaluation of the overall productivity of the plants grown in different containers. The vegetables were grouped based on the principles of companion planting which proves to enhance growth and create an integrated pest management system.

http://www.tastefulgarden.com/blog/wp-content/uploads/Vegetable-Container-Gardening.jpg

https://www.thefhd.net/wp-content/uploads/2013/07/window-box-cypress-wooden-planter-flower-choosing-wooden-planters.jpg

HERB SPIRAL

Creation and inclusion of an herb spiral at the Garden is a technique for increasing herb production for use by Campus Dining and Shops at the University. The design allows for multiple micoclimates to exist while using gravity and natural sunlight patterns to provide optimal growing conditions for many herb varieties. [4] The herb spiral will include dill, cilantro, sage, lavender, sweet basil, chives, French parsley, oregano, thyme, rosemary, peppermint, sweet marjoram, chamomile, Russian tarragon, coriander, and comfrey.

Representative diagram of the herb spiral design from EcologiaDesign.