Biointensive mini-farming in Ytterjärna, Sweden

January–October 2014

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Overview

In this project, I intended to learn biointensive agriculture techniques and put them into practice by implementing a proof-of-concept “mini-farm”. The primary goal was to test the promise of biointensive agriculture in general. A secondary goal was to introduce biointensive agriculture to Sweden and make any necessary adaptations for the Scandinavian climate and context.

Biointensive agriculture

Biointensive (sometimes written “bio-intensive”, short for “biologically intensive”) agriculture is a form of small-scale agriculture, where “bio” refers to the use of organic methods and building of soil fertility, and “intensive” refers to the focus on obtaining maximum yield from a minimum area.

Biointensive agriculture was developed in Northern California in the 1960s, when Alan Chadwick combined Rudolf Steiner’s biodynamic agriculture with French intensive gardening, which are in turn both based on organic growing practices used for thousands of years across the world. It was further developed and formalized by John Jeavons at the non-profit Ecology Action into a system called *GROW BIOINTENSIVE® Sustainable Mini-Farming*, which puts particular emphasis on closed-loop sustainability, self-sufficiency, and appropriate technology (AT).[1]

The term “biointensive” most commonly refers to the GROW BIOINTENSIVE system, popularized by the book *How To Grow More Vegetables* (a.k.a. “HTGMV” or “HTG”) by John Jeavons.[2] This project is based on GROW BIOINTENSIVE. However, other variations of biointensive agriculture exist. One notable model is described by Jean-Martin Fortier in his book,[3] based on his family’s experience from their 1.5 acre (6000 m²) market farm in Québec, Canada.[4] Fortier states that he prefers the term “biologically intensive”.

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[1] Web address http://www.growbiointensive.org

[2] Jeavons, John. *How to Grow More Vegetables (and Fruits, Nuts, Berries, Grains, and Other Crops): Than You Ever Thought Possible on Less Land Than You Can Imagine*, Ten Speed Press, 2012.

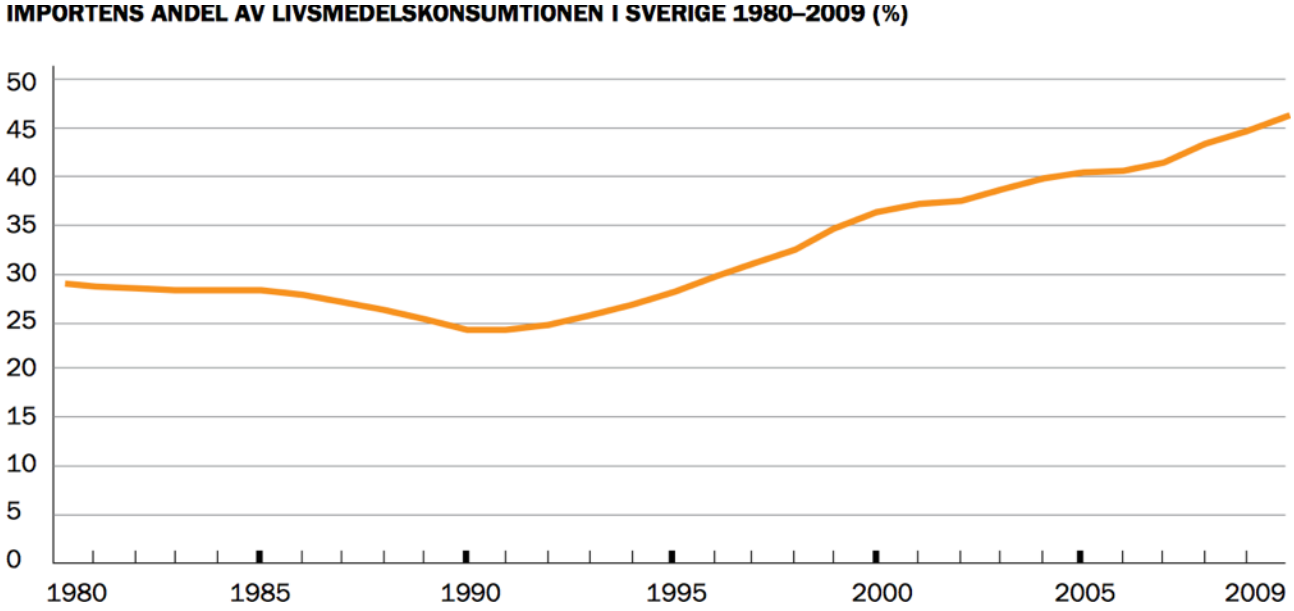
[3] Fortier, Jean-Martin. *The Market Gardener: A Successful Grower's Handbook for Small-Scale Organic Farming*, New Society Publishers, 2014.

[4] Web address http://www.themarketgardener.com

Background

This project was born out of a growing personal interest in sustainability and food. Specifically, it was a concrete attempt to answer the question: *How can we produce more local food sustainably?*

Today, nearly half of the food consumed in Sweden is imported, and the percentage is rising each year.[5] Much of what is produced in Sweden, furthermore, is grains, meat, and dairy products; fruits and vegetables are imported to a large extent from Europe and even South America and Asia.[6] It is sometimes believed that the Swedish climate is not conducive to growing fruits and vegetables, but Sweden was in fact much more food self-sufficient before political and economic changes restructured the domestic agricultural industry in the 1980s and 1990s—just one generation ago.



HALF OF FOOD CONSUMED IN SWEDEN IS IMPORTED. (LANTBRUKARNAS RIKSFÖRBUND, 2012)

With respect to environmental sustainability, arguments for local food are so well and widely articulated that they need not be repeated here. There is also the issue of food security. Sweden has a widespread reputation as a secure and advanced country, but even in the few years that I've lived here, we've experienced a number of food scares, from false labeling and adulteration (within individual supermarkets as well the EU horse meat scandal) to E. coli. We were also reminded of the fragility of our supply chains when the Icelandic volcano *Eyjafjallajökull* disrupted European air traffic in 2010.

There is final, simple reason why I'm interested in local food, and it has nothing to do with sustainability or security. It has to do with taste. Compare a vine-ripened heirloom tomato from your own garden with a standard supermarket tomato that's bred for function over flavor and picked weeks premature and shipped from another country, and well, it's clear which one is superior.

Before I moved to Sweden, I lived in the San Francisco Bay Area, California for almost 10 years. It was there that I first became "discovered" food. There, it's hard not to. There is fresh produce from Central Valley, world-class wine from Napa Valley, money from Silicon Valley, and ethnic diversity from across the world, making the Bay Area a heaven for foodies. My growing interest in food and cooking has let me to "follow the chain" upwards, toward the source.

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[5] "En trygg livsmedelsförsörjning globalt och i Sverige", Lantbrukarnas Riksförbund, 2012.

[6] "Fakta om maten och miljön", Rapport nr 5348, Naturvårdsverket, 2003.

It was also during my time in California that I first became interested in environmental sustainability and self-sufficiency, but it wasn't until 2012, when I took a permaculture (ecosystem design for self-sufficiency) course, that I finally put the two together, sparking an interest in sustainable food production. I went on to attend and organize some permaculture-related groups and events and also visited a number of urban agriculture projects, organic farms, and eco-villages around Stockholm and abroad. While there is currently a strong wave of interest in both permaculture and urban agriculture across the world, I have noticed that the level of food production at these projects is generally low, too low to make any sort of dent in the industrial food complex. After some failed attempts at gardening myself, I started researching organic growing methods more rigorously and come across biointensive agriculture, which is exactly what I was looking for.

In 2013, I attended Living Soil Forum, part of the **Summer of Soil** initiative in Ytterjärna, Sweden, where 130 participants gathered for a week around the topic of living soils. I mentioned in passing to Reinoud Meijer, one of the core organizers, that it would be "interesting" to try out biointensive agriculture on a bit of land somewhere.

During the Forum, I heard about **Skillebyholm**, a biodynamic school located just a few kilometers south of Ytterjärna. When I got home, I applied for a part-time biodynamic gardening course at Skillebyholm, starting in the fall.

Some weeks later, Reinoud emailed me saying that they had a plot of land that could be suitable for my idea and would I be interested in it? Up until this point, it had only been an "it would be interesting" idea in my head. I wasn't in any way qualified to implement a mini-farm. Now I would have to learn! Reinoud gave me the impetus that started the ball rolling.

Location and Site

The project site consists of approximately 200 m² (2150 sq ft) on the **Kulturcentrum Järna** campus in Ytterjärna, Sweden, about 50 km (30 mi) southwest of Stockholm. Kulturcentrum Järna and the immediately surrounding area consists of a cultural/educational center, a hotel, a farm-to-table restaurant, an extensive park, student residences, an international youth program, multiple biodynamic farms, an alternative/holistic medicine clinic, Waldorf schools, and other organizations and initiatives associated with anthroposophy. The Järna region is the capital of the anthroposophical movement in Sweden; there is strong support for alternative lifestyles and politics in the area in general.

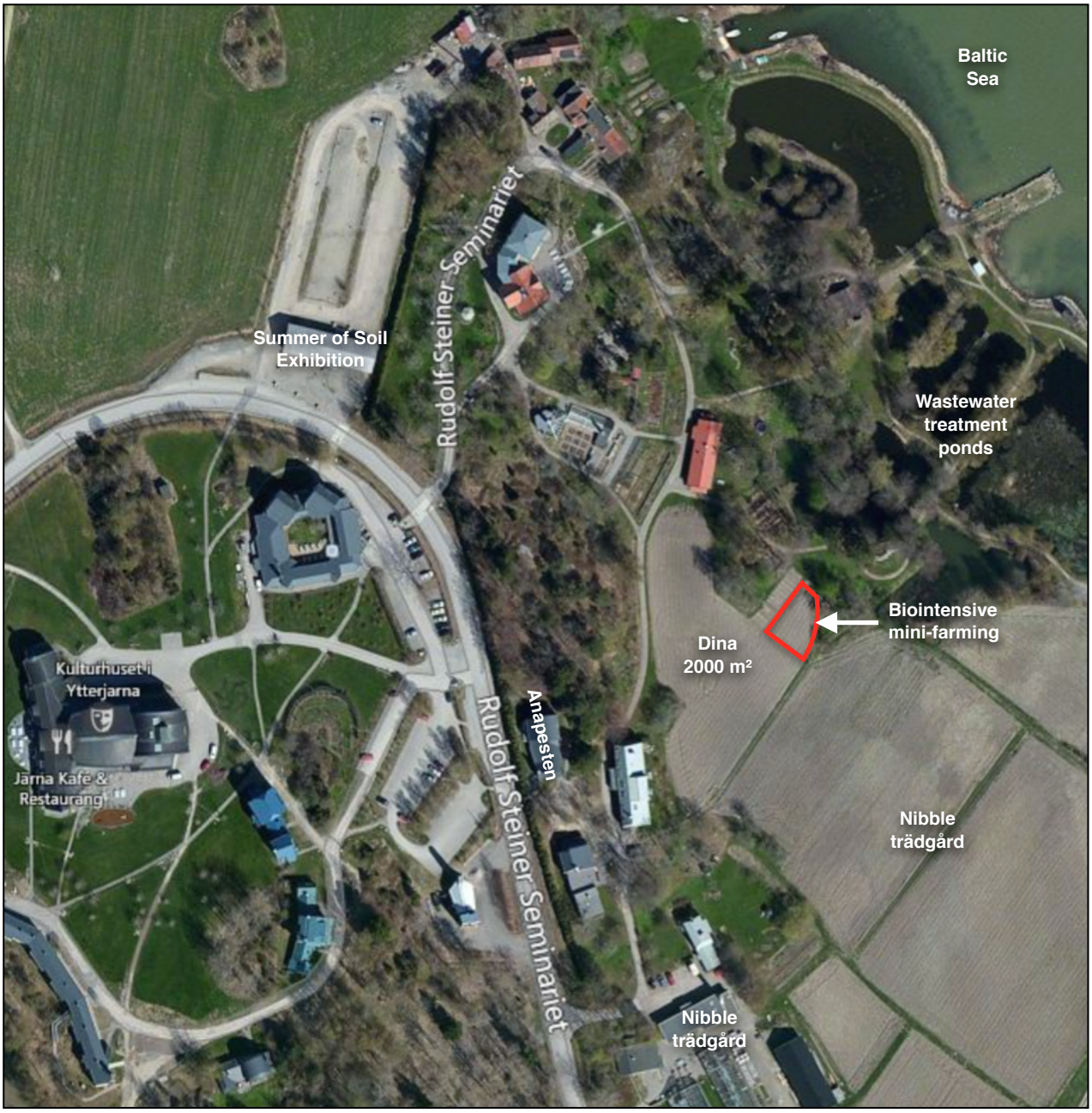
The project site is immediately neighbored to the south by **Dina 2000 kvadratmeter**, a 2,000 sq m (21,500 sq ft) demonstration garden designed to showcase the average amount of arable land available per person on Earth. To the west, there is a small private garden and compost piles; to the north there are wastewater treatment ponds draining into the Baltic Sea; to the south there is **Nibble trädgård**, a biodynamic market farm.

The site itself consists of heavy clay soil, previously part of Nibble trädgård but mostly fallow in recent years. Common weeds are couch grass (*kvickrot*), comfrey (*vallört*), sow thistle (*åkermolke*), lamb's quarters (*svinmålla*), dandelions (maskros), and stinging nettles (*brännässlor*).

[SEPTEMBER 13, 2013] THE UNDEVELOPED SITE, FULL OF WEEDS.

The USDA Plant Hardiness Zone is 6a, and the Köppen climate classification is Dfb (humid continental climate). The approximate growing season (*vegetationsperiod*) is May 15 to October 1 (in terms of last and first frost)[7], or 200 days (in terms of average temperature over 5°C per year)[8].

The GPS coordinates are 59.068793, 17.620322.



[7] "Frost och markfrost", SMHI, retrieved from http://www.smhi.se/kunskapsbanken/meteorologi/frost-och-markfrost-1.2789

[8] "Vegetationsperiod", SMHI, retrieved from http://www.smhi.se/kunskapsbanken/klimat/vegetationsperiod-1.6270; also "Vegetationsperiodens längd", SLU, retrieved from http://www-markinfo.slu.se/sve/klimat/vegper.html

Timeline

January: Training course in California

At the beginning of the year, I attended a two-week *GROW BIOINTENSIVE Sustainable Farmer Training and Crop Production Course* at the Ecology Action Research Mini-Farm in Willits, California, about 2.5 hours north of San Francisco.[9] There were attendees from all over the world (United States, Mexico, Kenya, Senegal, South Korea, and Sweden), a number of whom were very experienced and capable farmers.

It was an intense two weeks. Topics included not only GROW BIOINTENSIVE fundamentals (Soil and Fertility, Soil Nutrition, Diet Design, Crop Personalities, Seed Propagation, Plant Spacings, Companion Planting, Compost, Weed Management, Pest Management, Irrigation, Manual Tools) but also practical market farming topics (Farm Layout, Extended Harvest, Cooking, Coppicing, Agricultural Leadership, Income Farming, Farm Marketing, Data Collection) as well as "bigger picture" topics (Sustainability, Human Waste, Food Security, History, Philosophy, Self-Improvement, Future of GROW BIOINTENSIVE). I learned more in those two weeks than I ever knew before about growing food. I came out highly inspired and motivated to get my hands dirty, literally.

The entire course was recorded by a film crew, with the intention to make all of the contents available eventually as a paid online course on the web.

February: Moving in, meeting neighbors

It was clear to me from the very beginning that Kulturcentrum Järna would be an ideal place for this project. In my original project proposal (see Appendix A), I explained that I was not only looking for a piece of land, but also some form of accommodation (because Stockholm is 2 hours away by public transit) as well as access to a community of experienced gardeners and like-minded individuals (whom I can learn from and potentially work with). Kulturcentrum Järna was in a unique position to provide all of the above.

Soon after I got back to Sweden, in the middle of the dark Swedish winter, I signed a lease and checked into a student room on the Kulturcentrum Järna campus. On the very first evening, I met two neighbors living in the same corridor, **Nina Gramstad** and **Manuel Bazán**. Nina was actually in my same biodynamic class at Skillebyholm and expressed strong interest in my project and biointensive agriculture. Manuel had studied agriculture and forestry in university and was also interested in doing some gardening nearby.

I shared with them my newfound GROW BIOINTENSIVE knowledge and study materials with Nina and Manuel, including my copy of *How To Grow More Vegetables* and the self-teaching tools available online[10]. We performed some site observations and begin planning the project site around the 60-30-10 design guideline, where one grows 60% carbon-efficient crops (for replenishing the soil with organic matter), 30% calorie-efficient crops (for nutritional self-sufficiency), and 10% vegetables (also for nutritional self-sufficiency).

One important piece of advice that I received during the two-week farmer course was to start out simple and not try to do too much. With this in mind, we decided to limit the complexity by growing no more than 3 crops for each 60-30-10 category, or 9 crops in total, and also limit the size by

[9] Web address http://www.growbiointensive.org/MarketFarming/

[10] Web address http://www.growbiointensive.org/Self_Teaching.html

cultivating only 50 m² (5 beds) out of the total 200 m² area. (A full-sized GROW BIOINTENSIVE mini-farm, enough to feed 1 person, is 40 beds, so this would effectively be a 1:8 scale mini-farm.)

I also decided to reach out to **Studieframjändet**, one of the large associations for non-formal adult education in Sweden, with the idea of starting a study circle about biointensive agriculture. I thought it would be good to surround myself with as many experienced gardeners as possible, and I wanted to meet and work with more like-minded people in the area. Additionally, one of the goals of the project was to disseminate biointensive agriculture in Sweden. When I presented my project, **Mirja Eräpuro** and **Sofi Håkansson** were enthusiastic and highly supportive and really helped to raise the visibility of this project in local networks.

Finally, at the end of February, I attended another Summer of Soil event, a seminar on soil fertility and testing led by Dr. Håkan Wallander, professor in soil biology and environmental sciences at Lund University.[11] At this event, two of the fellow participants happened to be **Anette Forsberg** and **Chris Hedberg**, the farmers at nearby Nibble trädgård. I mentioned my project, and Chris mentioned that they were looking for help at Nibble trädgård. This started a dialogue that eventually turned into a mutually beneficial arrangement, in which I would volunteer on their farm on a weekly basis, and they would help me propagate seeds and keep them in their greenhouse and provide learning opportunities.

March: Planning and preparing soil

Nina, Manuel, Gustav, and I continued studying and planning together. By mid-March, we had a preliminary crop plan, and I submitted a short list of crops (leeks, kale, square, corn, tomato) that would need to be propagated indoors to Anette and Chris.

At Skillebyholm, a few classmates expressed interest in biointensive agriculture and my project. One in particular, **Gustav Sjöstedt**, would join (and later, lead) the study circle, despite the fact that he lives many hours north of Stockholm.

The study circle had its first meeting at **Järna Kafé**. I didn't know how many people would turn up, and I kept my expectations low. To my surprise, 10 participants showed up, some of whom travelled for hours from the far side of Stockholm just to attend. I also created a simple website at http://www.biointensiv.se/ to publicize the project and communicate with the study circle members.

In the second half of March, Manuel and I began preparing the soil surface, breaking down the large clumps of clay on the surface of the soil, starting in the northwest corner of the site, where we were planning to put the beds.

[11] Web address http://www.summerofsoil.se/events/lecture-hakan-wallander/

[MARCH 23] PREPARING THE SOIL SURFACE (AREA MARKED BY GARDEN FORK).

I started thinking that the trees to the east would partially shade a portion of the site, and checking satellite images of the area confirmed this suspicion. Based on this information, we decided to shift the 50 m² and also orient the beds toward the south, to maximize coverage from the sun.

Finally, at the end of the month, we began double-digging. It was still relatively early in the year, as the last frost date is in mid-May, and I received conflicting opinions if we should start digging or not. On one hand, it was suggested that we should do work any time nature presented the opportunity. For a farmer, it's always better to be early than late. On the other hand, it was suggested that we should simply wait, because digging in clay soil that is too wet would destroy the soil structure and result in something more like concrete, whereas waiting would allow the spring's freezing-thawing

cycles to breaking up clods naturally. The ideal thing to do would have been to dig before the winter, as Paula had advised, but I didn't have the opportunity to start the project in the fall.

Ultimately, we decided to start working instead of waiting.

In GROW BIOINTENSIVE, hand tools and human power are preferred over heavy machinery or animal power. All of the digging was done completely by hand.

[MARCH 29] DOUBLE-DIGGING THE FIRST BED.

April: Digging and sowing

We continued double-digging throughout April. Working mostly only weekends, we double-dug close to 3 beds by the end of the month. The weather was favorable, as the spring didn't turn out to be very wet.

In the rest of the plot outside of the beds, we sowed a blend of red clover (*rödklover*) and timothy grass (*timotej*) as a cover crop. The grass provides carbon, and the clover provides both carbon and nitrogen. Using a cover crop would also help control weeds in what would otherwise be bare soil.

At the end of April and beginning of May, we planted seed potatoes.

[MAY 3]: PLANTING SEED POTATOES.

Volunteer work: I also began working at Nibble trädgård as a volunteer one day per week. In April, the tasks mostly involved propagating and transplanting seeds, all inside a greenhouse. I was also tasked on occasion with building a raised bed and sowing in it:

May: Digging and planting

Through the month of May, we planted Jerusalem artichokes (sunchokes, *jordärtskockor*), sunflowers (*solrosor*), tomatoes (*tomater*), and fava beans (*bondbönor*). Double-digging also continued.

[MAY 17]: DOUBLE-DIGGING THE FOURTH BED.

By the end of May, the red clover, timothy grass, and potato plants had started appearing out of the ground.

[MAY 27]: RED CLOVER AND TIMOTHY GRASS (FOREGROUND), POTATOES (RIGHT-HAND BEDS).

Volunteer work: Propagating and transplanting continued into May. Occasionally I was also tasked with cultivating soil underneath plants to remove weeds and stimulate growth with aeration:

June: Planting and fighting slugs

In June, we finally planted out leeks, squash, kale, beans, and corn. We even continued double-digging into mid-June.


[JUNE 7] PLANTING LEEKS WITH OFFSET SPACING.
[JUNE 16] CORN, READY FOR PLANTING.

Quite a bit of energy went into battling Spanish slugs, which were suspected of eating the Jerusalem artichoke and sunflower plants. I started asking for coffee grounds at **Järna Kafé**, which I used to border the beds, especially where we planted the kale and beans.

[JUNE 9]: RAISED BED BORDERED WITH COFFEE GROUNDS.


LEFT: [JUNE 22] NEW POTATOES ON MIDSUMMER WEEKEND.
RIGHT: [JUNE 22] FAVA BEANS WITH CHARACTERISTIC OFFSET SPACING.

Volunteer work: Some of the tasks in June involved stringing up tomato plants and building a raised bed for planting more tomato plants:


July: Watering, weeding, and harvesting

July was an unseasonably warm month, with sustained temperatures above 30°C (86°F). Aside from harvesting potatoes, much of the action involved simply watering the plants. July is traditionally the month when Sweden goes on holiday, so the study circle took a pause for the summer. Nina and Manuel were kind enough to help water the plants during all the times I was not there.

At the end of June, I and everyone else renting student rooms at Kulturcentrum Järna had to move out, as the student housing were reserved for summer programs. This, coupled with the prolonged holidays in July, caused some momentum to be lost, both in this project and in the study circle.

[JULY 6]: HARVESTING POTATOES.

[JULY 11]: CULTIVATING LEEKS.

Volunteer work: I did not work the full month due to some holidays but of the times that I was there, we worked outside in the field, weeding, cultivating, and putting up a fence:

August

In August, most of the work involved cutting the cover crops, weeding, and harvesting potatoes, fava beans, and tomatoes.

We had a problem with both flea beetles and large white caterpillars, and again Spanish slugs heavily attacking the cabbage plants.

At the end of August, I concluded my volunteer work at Nibble trädgård. I would have liked to continue through the end of the season but I was starting full-time work again in September.

[AUGUST 9] FROM LEFT TO RIGHT: LEEKS, SQUASH, CORN, AND A SUNFLOWER.

[AUGUST 9] FLEA BEETLES ON LACINATO KALE
[AUGUST 30] LARGE WHITE CATERPILLARS ON LACINATO KALE

September

By early September, the pest attacks had subsided somewhat and most of the cabbage plants had started to recover. This demonstrates one of the tenets of organic agriculture: healthy plants in a

healthy ecosystem will often be able to defend themselves and recover from pests, without artificial intervention.

The yellow flowers are the Jerusalem artichokes.

[SEPTEMBER 13] SPANISH SLUG ON KALE.
[SEPTEMBER 13] MANUEL WORKING WITH SCYTHE.

October

There is plenty of kale left to harvest. The plants have made almost a complete recovery since the pest attacks in August.

Observations

Time spent

The “field time” in this project was recorded to be roughly 145 person-hours, from late March through mid-September, a 26-week period. This works out to be about 5.5 hours per week, the bulk of which was spent in the spring months preparing the soil and plants.

The field time does not count the significant hours spent in studying, planning, meeting, and documenting, nor does it include the time spent organizing and participating in study circle activities.

Metric units

During the course in California, I consulted with **Patricia Mayagoitia** who is working in Mexico and other countries where the Metric system is used. She said that they take the original definition of 1 GROW BIOINTENSIVE bed = 100 sq ft = 9.290 m² and round it an even 10 m² to make calculations easier, and use a standard 125 cm (4 ft 1 in) bed width. We followed these same size translations in this project.

In other words, a metric GROW BIOINTENSIVE bed is 125 × 800 cm, or 10 m².

Raised beds

We built our first raised bed mostly according to the instructions. Two issues arose:

- The raised beds used in GROW BIOINTENSIVE are raised due to aeration of the soil, not due to the addition of any material. With our heavy clay soil, it was considerably difficult to break down the large chunks to a fine structure, so the bed did not as raised as we had desired. The result was a semi-raised bed.
- The bed was mostly flat on top. With rain, clay soil forms a hard, thin shell on the surface. As the Swedish climate can be very wet at times, I became worried about drainage, especially if the center of the bed would sink lower than the sides (concave).

In our second attempt at building a raised bed, we added much more organic material in the form of compost than in the first attempt. Also, we tapered the top slightly so that water would properly run off the clay shell on the bed’s surface.

Even with a strictly flat raised bed, the sides of the bed will be somewhat tapered or rounded inward. The usable surface of the raised bed, then, is actually smaller than the base of the bed. Bed size measurements actually should take this into account.

Double-digging

The idea behind double-digging (*dubbelgrävning*) is to prepare the soil deeply, allowing roots to grow deeper and reach more water and nutrients, as well as providing aeration and improved drainage of the soil. Double-digging is a characteristic feature of GROW BIOINTENSIVE and perhaps the most polarizing. Some experienced farmers and gardeners that I talked to said it was “a lot of work”, silly to do by hand, or that they were “too lazy” to do it even though they acknowledged it was “very good” to do. Indeed, even though we started double-digging at the end of March, working mostly only on weekends, it took us all the way through May to finish.

Due to our heavy clay soil, it took us roughly 1 hour per square meter, or 10 hours per bed, which was in line with the high side of the estimates given in *How To Grow More Vegetables* ("6½ to 11 hours to dig and transplant a 100-square-foot bed").

An average adult can only double-dig for a few hours per day before getting tired. Double-digging 40 beds for a full-scale mini-farm would therefore take 4 months, assuming one works 6 days a week (with 1 day for rest). Only the most devoted practitioner would ever do this, and this assumes perfect weather conditions. More realistically, one would need additional labor (which demands social or financial capital), the use of a U-bar or mechanization, or alternatively, to build up the mini-farm over a series of years.

Interestingly, students at Gävle University College (*Högskolan i Gävle*) compared single-digging and double-digging and concluded that double-digging may not be suitable for all crops. For example, they found that parsnips grew better (thicker and heavier) in single-dug soil, presumably because there was too little resistance in the double-dug soil.[12]

One notable benefit of double-digging is that it makes it easier to remove rhizome weeds such as couch grass (*kvickrot*), which would otherwise be hard to control. Some of the time invested up-front in double-digging clearly paid off with less time weeding later in the season.

Offset spacing

Another a characteristic feature of GROW BIOINTENSIVE is offset spacing, meaning the plants are spaced in an offset grid pattern, rather than in traditional rows, in order to grow more intensively. This is a nice idea in theory but we ran into some difficulties in practice:

- It is harder to plant using offset spacing than in rows. Especially if the soil is chunky like ours, the spacing becomes inaccurate, which can have a domino effect if you're not careful.
- Cultivation with hoes becomes considerably harder if the spacing isn't kept clean and precise, which is hard to do, as described previously.

Some study circle participants also reported difficulties with spacing in their own gardens.

Instead of using triangulation (using a spacing stick or template to measure triangles), we developed a technique where we plant everything in rows but simply offset every other row. This provides the benefits of offset spacing with the ease of rows.

Overall, though, offset spacing feels like a premature optimization, as we call it in software engineering, especially for beginning gardeners. Jean-Martin Fortier does not use offset spacing on his biointensive farm. In most situations where there is abundance space, I believe it is more important simply to get people to grow their own vegetables, without complicating it too much.

Companion planting

In the study circle, there was a good deal of interest in companion planting. People seem to like the idea of plants mutually benefiting one another. Again, though, we ran into some difficulties putting the idea in practice:

[12] "Resultat av trädgårdsmästarstudenternas odlingsexperiment på Wij trädgårdar", Högskolan i Gävle, 2012. Retrieved from http://www.hig.se/Ext/Sv/Utbildning/Hitta-utbildning/Program/Programsidor/Grundniva/Tradgardsmastarprogrammet-med-inriktning-mot-halsa-och-design-180-hp/Studentprojekt/Resultat.html

- Using row covers can be problematic with companion planting, especially if plants have different sizes. We planted Three Sisters and wanted to cover the squash while letting the beans and corn for freely, for example. Combined with intensive spacing, it was not easy to cover the squash selectively.
- It's unclear how to do any kind of spacing calculations for offset spacing combined with companion planting, and measuring the spacing out on the field seems extraordinarily difficult. *How To Grow More Vegetables* merely shows a solution for "3-Crop Companion Planting" without explanation.

How To Grow More Vegetables notes that companion planting over time (i.e. crop rotation) is "easier, and probably just as effective" as companion planting over space, but people seem to still want to try to do companion planting over space.

Pests

The Spanish slug (*spansk skogssnigel*, commonly called *mördarsniglar*), a non-native invasive pest, is a serious problem in many parts of Sweden. It felt like in almost study circle meeting, we discussed slugs. There's no silver bullet, but everyone seems to have their own favorite tricks: using crushed egg shells, coffee grounds, copper wiring, metal fences, beer traps, nematodes, etc. The only surefire solution seems to be to check on your garden on a regular basis and pick them away by hand.

I bordered the beds with coffee grounds (see June in the Timeline section) and that seemed to help. We also started using cut-up plastic water bottles to protect the fledgling plants, and we used a scythe to mow the weeds around the area, for beautification but also to try to reduce the amount of slug-friendly habitat. Slugs are the reason why I chose not to mulch the beds or pathways with straw or other materials. Watering in the mornings instead of the evenings is also said to help, and this is what we tried to do.

Additionally, we had problems with both flea beetles (*jordloppor*) and large white (*cabbage butterfly*) caterpillars (*kålmaskar*); see August in the Timeline section. This was apparently a widespread problem in the region, as it affected Nibble trädgård as well as other study circle participants. We covered the plants with a row cover (*fiberduk*) to not only enclose the plants but also make a less comfortable space for the flea beetles as the row cover helps shake the leaves in any wind. This seemed to help quite a bit. **Ulla Troëng**, a study circle participant, wrote that she tried companion planting with basil and oregano to protect against large white caterpillars, but this did not help, although the plants next to the oregano did last the longest.

Potatoes

Our primary calorie crop was potatoes, which are commonly eaten in Sweden and grow well here. Participants of the study circle immediately asked about hilling, the practice of piling soil up around the base of a plant, which is done to prevent potatoes from turning green due to exposure to light.

I could not find any guidance in *How To Grow More Vegetables* on growing potatoes except for a short note in the section on double-digging: "After the lower trench has been loosened, potatoes may be placed on its surface on 9-inch centers using offset spacing. The soil from the next trench's upper level may then be moved forward onto them. This is the easiest way we have found to plant potatoes."

I turned to the Internet and found a blog post[13] on biointensive potato farming by Dan Royer-Miller, formerly of The Golden Rule Garden in Willits, CA. I commented on his blog post; our dialogue is reproduced here:

> **JOHN C—APRIL 30, 2014 AT 2:01 PM**
> Hi, thanks for this post! HTG barely mentions potatoes at all. We are planting potatoes in an (attempted) biointensive garden and we were wondering about hilling, specifically how to do it with the offset spacing. You state here that trenching and hilling aren't required, but won't the potatoes turn green without hilling? Or could you clarify the bit about tubers growing upwards? I don't really get the significance of that in not needing hilling. Thanks a bunch!
>
> **DAN R-M—APRIL 30, 2014 AT 6:37 PM**
> Hey John! Thanks for your comment.
>
> It's true, potatoes grow upwards, and if you simply lay the seed potato on the ground it will turn green and have nowhere to go. We've experimented with two methods of planting - the first is an adapted double dig where you plant the potatoes at the bottom of the trench after loosening soil and cover them with the soil from the next trench.
>
> The second method comes after the double-dig, and involves using a narrow spade to create a crevasse, drop the seed potato in, and let the soil collapse around it. Either way it's a bit tricky to keep track of where the potatoes are spaced, but potatoes aren't really a low-labor crop anyway :)
>
> Margo points out that, in hilling, the soil needs to come from somewhere. With the permanent beds that GB utilizes, the question of where the extra soil will come from is a little trickier than with an open-format garden.
>
> **JOHN C—MAY 1, 2014 AT 2:25 PM**
> Hi, thanks for the response! Yeah, HTG mentions the first method in kind of a footnote but we had already double-dug the bed so we kind of stumbled upon your second method, but we had exactly the problem keeping track of the potatoes as you said! One of the people in our group started marking each potato with a handful of compost on top, which worked well. But the "traditional" method of using rows seems way easier, so we were wondering if we were missing something. Good to get confirmation that we're on track.
>
> So planting 6" deep is the key to preventing green potatoes without hilling?
>
> **DAN R-M—MAY 11, 2014 AT 11:21 AM**
> Yeah. In fact, if the soil is loose (so they could climb up and out well) and you are ambitious, you could try planting them deeper.
>
> We've used different methods to track where potatoes were spaced. The post above talks about the board, which had markings for offset spacings on either side, and which we would flip over as we'd complete a row. I have also used sticks, just a little branch or something, and mark where the potatoes on the outsides of the bed were in the previous row. The handful of compost sounds effective, too.
>
> People sometimes express skepticism at the amount of work this takes, but I've hilled, too, and that's no slight task. One day we may run a test for ourselves…

---

[13] Royer-Miller, Dan. “This Spud's for You, Part II”, *The Golden Rule Garden* blog, April 10, 2009. Retrieved from http://goldenrulegarden.blogspot.hk/2009/04/this-spuds-for-you-part-ii.html

It seems that even a highly experienced GROW BIOINTENSIVE practitioner doesn't have any hard answers on growing potatoes. For such a common staple crop, it would be good if *How To Grow More Vegetables* included more specific guidance on this topic.

Since potatoes grow upwards, not downwards, the use of double-digging seems like overkill. I would be interested to compare yields between growing potatoes in a double-dug bed and in a conventional bed.

Aesthetics

The importance of aesthetics was something that I realized after starting this project. During the planning phase, I was more concerned with following the GROW BIOINTENSIVE method and not thinking much about aesthetics. Especially for this project, which is located in a public visitation park, with neighboring projects, I found it important to not only try get the proper yields but also do so in a presentable manner.

Thoughts

During the course of this project, I read some influential books and articles on food and agriculture politics by Dan Barber, Mark Bittman, Nathanael Johnson, and Tracie McMillan. Along with my learnings directly from this project, these readings have colored my thinking about food and sustainable agriculture.

Organic versus sustainable

In recent years, organic food has broken into the mainstream, with even McDonald's and Walmart having moved into the space. An important realization for me, however, has been that **organic and sustainable are orthogonal concepts**, i.e. one does not necessarily imply the other. Use of organic fertilizer or pesticides instead of artificial fertilizer or pesticides, for example, does not make things automatically any more sustainable. The opposite may in fact be true. It is not uncommon for organic agriculture to be practiced on an industrial scale, where the letter but not the spirit of the law is followed, where conventional practices are simply replaced by organic ones, without shifting focus to soil or ecosystem building. Organic certification is a minimum bar: better than nothing, but not nearly enough. (In contrast, sustainability is designed into biodynamic agriculture and GROW BIOINTENSIVE, as a "built-in feature".)

The dominant understanding of what is "good", "happy" sustainable food is the one popularized by Alice Waters and Michael Pollan, among others, where food should be fresh, local, seasonal, organic, and humane, ideally simply prepared and unadorned. In this understanding, nature is the best chef. Dan Barber argues that this romantic notion is fundamentally impractical, even elitist, as **this kind of hyper-selective sourcing does not scale up to feed a planet**.[14] We simply cannot be eating chicken breasts and salmon fillets and heirloom tomatoes all the time, no matter if it's local and organic or not. This conception of "sustainable" food is not truly sustainable.

Even within a vegetarian or vegan diet, which is often argued to have a lesser environmental impact, certain crops are more sustainable than others. It makes more sense to grow and eat fava beans than tomatoes, for example, because legumes fix nitrogen in the soil (through a symbiotic relationship with soil bacteria), whereas tomatoes demand lots of water and are not particularly calorie-efficient. In having to balance carbon production, calorie production, edible weight, and land area, the GROW BIOINTENSIVE diet design process really drives home the notion that **we have to be willing to change our diets** if we want to be serious about sustainability.

Good versus easy

Having now made an actual attempt to produce local food, **I do believe that biointensive agriculture offers a workable solution**. However, it seems that any sort of agriculture, even at the smallest scale, is a demanding effort: demanding time, knowledge, interest, and physical capability. In other words, sustainable local agriculture is not easy, even if biointensive methods make it generally possible.

I've decided that you can give someone a box of the highest-quality vegetables, straight from the farm, but that doesn't guarantee that they won't go to rot. Nowadays, **many people don't really cook**. People don't know how, aren't willing to, and/or don't have the time and energy to cook. I admit to this myself sometimes, for example at the end of a long work day. Given that people today don't cook the food that they already have access to, expecting people to grow their own food is kind of ludicrous.

---

[14] Barber, Dan. *The Third Plate: Field Notes on the Future of Food.* Penguin Press HC, 2014.

In her book, Tracie McMillan explores the question of why it's easier to eat junk than to eat well.[15] The insight that what is *good* and what is *easy* aren't the same has lead me to think that "how to produce more local food sustainably" may not be the right question. Perhaps we should be asking "how to make gardening easier", which could take the form of educational materials or even apps. Alternatively, asking "how to make cooking easier" would be something that automatically increases awareness and demand for local, fresh produce. Ultimately, *easy* will always win over *good*, so **we have to find ways of making *good* easier**.

Production versus distribution

With this project, my initial (naive) vision was that backyards, parks, and the like could be turned into mini-farms. Even if this kind of local food production could cover some 5% of total consumption, that would make a huge difference, I thought.

As I have learned, generally speaking there is not a problem of food production in the world but rather **food access and distribution**.[16] Additionally, Tracie McMillan points out that for every dollar spent on food, only about 15¢ goes to the farmer; the other 85¢ goes to the entire chain between farm and table. I suspect, but I don't know, that **there are great inefficiencies to be found here**. Certain solutions such as direct-trade and Community Supported Agriculture (CSA) exist, but clearly more needs to be done.

Another realization I had was that not all food has to be equally local. Root vegetables, for example, store and transport well, whereas leafy greens do not. Certain plants are easier to grow in containers than other plants. **A one-size-fits-all solution is not optimal**.

---

[15] McMillan, Tracie. *The American Way of Eating: Undercover at Walmart, Applebee's, Farm Fields and the Dinner Table.* Scribner, 2012.

[16] Johnson, Nathanael. "Is producing more food to feed the world beside the point?", *Grist Magazine*, August 18, 2014. Retrieved from http://grist.org/food/is-producing-more-food-to-feed-the-world-beside-the-point/

Conclusions

In the span of less than a year and a half, from Summer of Soil (July 2013) to the time of this writing (October 2014), I have gone from having very little knowledge of soil and farming to at least a beginner's level, enough to feel comfortable to proceed further on my own. Everything from the Summer of Soil forum to the Skillebyholm part-time education, the GROW BIOINTENSIVE course, the Studiefrämjandet study circle, and the Nibble trädgård volunteer work have made my journey of learning an immensely fruitful and rewarding one.

This project formally ended in mid-October. Manuel will be taking over the garden plot for next year, where he plans to continue some biointensive practices as well as try to introduce Spanish techniques in Sweden. Nina plans to introduce biointensive agriculture in her home country of Norway. I intend to make myself available to assist both Manuel and Nina.

I feel like I have successfully achieved what I set out to learn in this project. I do not have specific plans for next year, but I am thinking about how to move forward. As discussed in Thoughts, I have become interested in how to make cooking and/or gardening dramatically easier for general audiences, as well as exploring potential inefficiencies in the distribution chain, both possibly through the use of technology, which is my formal area of expertise.

Acknowledgments

I am very grateful for all of the support I have received from following individuals and organizations, without of which this project would not have been possible.

Special thanks to Manuel Bazán, Nina Gramstad, and Gustav Sjöstedt for their indispensable help “on the ground” and all-around friendship.

Individuals

- **Reinoud Meijer** (Summer of Soil) for listening to me and helping kickstart the project.
- **Janecke Wyller** and **Paula Pihlgren** (Kulturcentrum Järna) and **Mirja Eräpuro** and **Sofi Håkansson** (Studiefrämjandet) for your executive support.

- **Manuel Bazán** for being a wonderful “technical advisor”, helper, and friend.
- **Anette Forsberg** and **Chris Hedberg** (Nibble trädgård) for sharing your knowledge and opening your doors to me.
- **Reinout Gerretsen** (Kulturcentrum Järna) for teaching by example and being a friendly neighbor.
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- **Ulla Andersson, Eva Anderstedt, Nina Gramstad, Elsy Olofsson, Patrik Södergren, Ulf Sjöberg, Gustav Sjöstedt, Anette Svedberg, Ulla Troëng, et al.** (study circle participants) for your interest, enthusiasm, and fellowship.

- **Åsa and Alan Moum** for your unwavering moral support.

Local Organizations and Projects

- **Dina 2000 kvadratmeter** (Ytterjärna), https://www.facebook.com/Dina2000Kvadratmeter
- **Goda Livets Trädgård** (Ytterjärna), https://www.facebook.com/GodaLivetsTradgard
- **Järna Kafé** (Ytterjärna), http://www.jarnakafe.se
- **Kulturcentrum Järna** (Ytterjärna), http://www.kulturcentrum.nu
- **Nibble trädgård** (Ytterjärna), http://ytterjarna.se/en/guide/nibble-tradgard/
- **Skillebyholm** (Skilleby), http://www.skillebyholm.org
- **Smaka framtiden** (Södertälje), http://www.smakaframtiden.se
- **Studiefrämjandet Söderort** (Södertälje), http://www.studieframjandet.se/soderort
- **Summer of Soil** (Ytterjärna), http://www.summerofsoil.se
- **Under tallarna** (Järna), http://undertallarna.se

Additional Organizations

- **Ecology Action** (Willits, California), http://www.growbiointensive.org

Appendix A: Original Project Proposal

September 2013

Biointensive Mini-Farming in Ytterjärna

Background

Biointensive farming refers to organic agriculture with a focus on maximum yield from minimum area, while building soil fertility at the same time. Simply put, it is sustainable, small-scale intensive farming.

In January 2014, I am planning to take a 4-week course in Northern California on a specific system of biointensive farming called GROW BIOINTENSIVE®, developed by John Jeavons and deployed around the world since the 1970s. This system is based on earlier work by Alan Chadwick, who was a student of Rudolf Steiner.

Objectives

I intend to create a proof-of-concept "mini-farm" implementing the techniques that I will have learned in the GROW BIOINTENSIVE® course. The primary goal is to test the promises of biointensive farming in general. A secondary goal is to introduce biointensive farming to Sweden and adapt existing methods to the Scandinavian climate and context as necessary.

Requirements

I will be self-funding the project from my own savings, so I am not requesting any funds. However, I am looking for a place for the mini-farm, a place to sleep nearby, and people to be around:

Mini-farm site

• 500 m² of gardening space, with access to water and a toolshed.
• Access to a workshop with basic tools for constructing wooden seed flats, nursery area, etc.

Part-time accommodation

A student room or similar in or near Ytterjärna would be a huge plus, because biointensive farming is an intensive system and there is great educational value in spending as much time as possible on-site.

Community

Most importantly, I am looking to be part of a community of experienced gardeners and like-minded individuals whom I can learn from and potentially work with. This is why I am seeking to implement this project in Ytterjärna rather than anywhere else in the Stockholm area.

Schedule

The project is proposed to run for two full calendar years (2014 and 2015), with possibility for extension.

About me

I work as a software engineer, currently at Skype in Sweden and previously at Apple in California. Although my background is in computer science, over the past decade I have become interested in sustainability and environmental issues. I have completed a M.A. in Science, Technology, and Society (STS) with specialization in Innovation Systems, Social and Ecological Change, and I have a Permaculture Design Certificate (PDC) from the Permaculture Institute of Australia. This summer I participated in Summer of Soil Living Soil Forum, and I am currently taking a Biodynamic gardening course at Skillebyholm.

John Chang
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Appendix B: Study Circle Info Sheet

March 2014

Biointensive Mini-Farming—Study circle in Ytterjärna and online

How do you grow the most food in the smallest space, fully organically, while building soil fertility at the same time? Ecology Action, a non-profit organization in California, has been working on exactly this question since the early 1970s. They have developed a method called GROW BIOINTENSIVE® Sustainable Mini-Farming. It has been adopted across Latin America, Africa, and Asia over the past 40 years.

This study circle is for people who are passionate about sustainable small-scale organic food production and want to explore GROW BIOINTENSIVE together. All skill levels are welcome, but commitment to the use of organic methods is a must.

We will meet once a month in Ytterjärna and also correspond over the Internet. You must have your own garden plot and/or participate in developing the test site at Trädgårdsparken Kulturcentrum Järna.

Biointensiv odling—Studiecirkel i Ytterjärna and på distance

Vill du lära dig att odla så mycket mat det bara går på en så liten yta som möjligt, helt ekologiskt och samtidigt öka jordens bördighet? Sedan 1970-talet har Ecology Action som är en ideell organisation i Kalifornien, arbetat med just detta och utvecklat en metod som kallas GROW BIOINTENSIVE® Sustainable Mini-Farming. Metoden har använts i Latinamerika, Afrika, och Asien under de senaste 40 åren.

Denna studiecirkel är för dig som brinner för hållbar småskalig ekologisk grönsaksodling och vill utforska GROW BIOINTENSIVE tillsammans. Alla nivåer är välkomna men vi delar ett engagemang för hållbarhet och ekologiska metoder.

Vi kommer att träffas en gång per månad i Ytterjärna och hålla kontakt via Internet. Du bör ha din egen odlingslott eller delta i utvecklingen av försöksplatsen på Trädgårdsparken Kulturcentrum Järna.

Dates:

- Sat 2014-03-22 13:00–17:00, Järna Kafé - introductions, GB theory, diet design & crop planning
- Fri 2014-04-11 19:00–21:30, Kulturcentrum Järna
- Fri 2014-05-09 19:00–21:30, Kulturcentrum Järna
- Fri 2014-06-13 19:00–21:30, Kulturcentrum Järna
- Sun 2014-08-03 19:00–21:30, Kulturcentrum Järna
- Fri 2014-09-?? 19:00–21:30, Kulturcentrum Järna
- Fri 2014-10-?? 19:00–21:30, Kulturcentrum Järna

Study materials: Available online at http://www.biointensiv.se/studiecirkel. You may wish to purchase your own copy of *How To Grow More Vegetables*.

Cost: Free. (For those in the Ytterjärna gardening group, please bring your own gardening tools).

Language: English and Swedish

Contact: John Chang, jrc@collapselabs.org, 076-775 35 65

Latest info and course application at http://www.biointensiv.se/studiecirkel

Studie främjandet

Trädgårdsparken Kulturcentrum Järna

TRANSITION NETWORK OMSTÄLLNING JÄRNA

Appendix C: Study Circle Bed Design Worksheet

March 2014

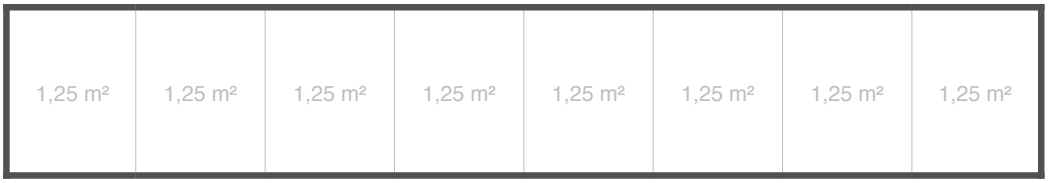
Biointensiv odling

www.biointensiv.se/studiecirkel

2014-03-22 Exercise: Designing a One-Bed Unit

A typical GROW BIOINTENSIVE mini-farm design consists of 40 beds or approximately 400 m² (1 bed is defined as 100 sq ft ≈ 10 m²). This target size is common because 40 beds is fairly manageable for one person to do part-time, once one's soil and skill are built, and many of the world's people only have access to such a limited area.

As a first step toward having your own mini-farm, you have decided to grow a 1-bed unit.



1 bed ≈ 10 m² (8 m × 1,25 m)

Your goal is to produce a design that balances the following parameters:

- **Area:** 1 bed is ~10 m².
- **Edible Yield:** An average person eats ~2 kg of food per day. A man can eat up to ~2.7 kg of food per day, a woman up to ~2.5 kg per day.
- **Calories:** The average person in the world needs 2400 calories per day.
- **Air-Dry Biomass:** ~13.6 kg of compost material is needed for continued soil fertility.

To help you achieve a balanced design, use the 60/30/10 guideline (HTGMV p.39):

- **60% Area for Carbon Crops (e.g. grains)** that produce large amounts of carbon for compost and also significant amounts of calories. (Legumes can also be interplanted to produce immature biomass and fix nitrogen in the soil if they are harvested at 50% flower.)
- **30% Area for High-Calorie Crops (e.g. potatoes)** that produce large amounts of calories in limited space per unit of time. In other words, they are both area and weight efficient.
- **10% Area for Nutrition/Vitamin/Income Crops (e.g. salads)** for additional vitamins and minerals and/or income. These crops do not produce a large amount of calories or carbon in a limited space.

Keep in the mind:

- If you choose to eat more Carbon Crops, the weight of the food you eat will generally be less per day but the area needed to grow your diet will generally increase.
- If you choose to eat more High-Calorie Crops, the weight of the food you eat will generally be more, but the area needed to grow your diet will generally decrease.
- If you choose to eat a diet with a large variety of crops, planning your garden/mini-farm will be more complex as there will be considerations in terms of phasing crops, harvesting, and preservation.
- If you grow a lot of non-interplanted legumes (besides fava beans) as part of your diet, they will reduce the weight of the diet you eat, but will significantly increase the area needed for the growing of your diet, as legumes are not very area efficient for the production of calories. In addition, your design may produce more protein than is optimal for a person to consume.

Complete page 2 using **intermediate** yields (i.e. the middle figure in Col. O in the Master Charts in HTGMV).

N.B. This is a learning exercise. We are not looking for perfect solutions.

1 of 3

60% Carbon Crops (choose any 2 from page 3)

	A	B	C	D	E	F	G	H	I	J
Crop	**Area**	**Edible Yield**			**Calories**			**Air-Dry Biomass**		
	m²	**lb/bed** HTGMV Col. O	**kg/bed** B×0.454 kg/lb	**kg** C÷10×A	**cal/lb** HTGMV Col. X	**cal/kg** E÷0.454 kg/lb	**cal** D×F	**lb/bed** HTGMV Col. O	**kg/bed** H×0.454 kg/lb	**kg** I÷10×A
Corn, Flour	3	17	7,7	2,3	1656	3648	8446	48	21,8	6,5
SUBTOTAL	**6**	×3 yield if necessary (to hydrate for eating)								

30% High-Calorie Crops (choose any 2 from page 3)

	A	B	C	D	E	F	G	H	I	J
Crop	**Area**	**Edible Yield**			**Calories**			**Air-Dry Biomass**		
	m²	**lb/bed** HTGMV Col. O	**kg/bed** B×0.454 kg/lb	**kg** C÷10×A	**cal/lb** HTGMV Col. X	**cal/kg** E÷0.454 kg/lb	**cal** D×F	**lb/bed** HTGMV Col. O	**kg/bed** H×0.454 kg/lb	**kg** I÷10×A
Potato, Irish	1,5	200	90,8	13,6	349	769	10470	—	—	—
SUBTOTAL	**3**									

10% Nutrition/Vitamin/Income Crops (choose any 1)

	A	B	C	D	E	F	G
Crop	**Area**	**Edible Yield**			**Calories**		
	m²	**lb/bed** HTGMV Col. O	**kg/bed** B×0.454 kg/lb	**kg** C÷10×A	**cal/lb** HTGMV Col. X	**cal/kg** E÷0.454 kg/lb	**cal** D×F
Squash, Winter	0,5	100	45,4	2,3	171	377	855
SUBTOTAL	**1**	×3 yield if necessary (to hydrate for eating)					

60% Carbon Crops

English	Swedish	Air-dry Biomass lb/bed
Alfalfa	Alfalfa	69
Corn, Flour or Fodder, Dry	Mjölmajs	48
Sunflowers	Solros	40
Cardoon	Kardon	40
Clover, Medium Red	Rödklöver	36
Beans, Fava, Cold-Weather	Bondbönor	36
Timothy-grass	Timotej	35
Clover, Crimson	Blodklöver	30
Barley	Korn	30
Oats	Havre	30
Wheat, Various	Vete	30
Rye, Cereal	Råg	30

30% High-Calorie Crops

English	Swedish	Calories, Green per lb
Garlic	Vitlök	676
Potatoes, Sweet	Sötpotatis	430
Salsify	Svartrot	372
Potatoes, Irish	Potatis	349
Artichoke, Jerusalem	Jordärtskocka	345
Parsnip	Palsternacka	340
Leeks	Purjo	277

Goals vs. Your Totals

	K	L	M	N	O	P
	Goals		**Your Totals**		**Adjusted Totals**	
	per day	**each bed** K × 365 days ÷ 40 beds	**each bed** from page 2	**Adjustment Factor***	**each bed** M × Adjustment Factor	**per day** O ÷ 365 days × 40 beds
Area	—	10 m²	10 m²	—		—
Edible Yield	~2 kg/day; max 2.5 kg/day	~18.3 kg; max 22,8 kg	Sum of Cols. D	—		
Calories	~2400 calories/day	~21900 calories	Sum of Cols. G	M ÷ L	~21900 calories	~2400 calories/day
Air-Dry Biomass	—	min ~13.6 kg	Sum of Cols. J	—		

** If your design produces more calories than the goal, use columns N–P to determine how much area you need to reach the goal. (N.B. Some of the other goals may not be met.)*

In an area where double-cropping is possible, fewer beds may be needed. This requires intermediate to advanced planning skills.

Appendix D: Ytterjärna Site Crop Planning

March 2014

	Crop		Edible Yield			Calories			Biomass, air-dry			Plants			Source/Varietal	Planting	Notes
			HTG Col O			*HTG Col X*			*HTG Col O*			*HTG Col N*				Sista vårfrosten v. 20	
		m²	lb/bed	kg/bed	kg	cal/lb	cal/kg	cal	lb/bed	kg/bed	kg	#/bed	#	4 beds			
60% Carbon	**Alfalfa (Lucerne)**	**3,00**	0,0	0,0	0,0	0	0	0	69,0	31,3	9,4	833	250	1000	Olssons		
	Corn, Feed, Dry	**2,00**	17,0	7,7	1,5	1 656	3 651	5 630	48,0	21,8	4,4	84	17	**67**	***RB Painted Mountain***	v. 14–16	Så inomhus eller i bänk 4-6 veckor innan utplantering, ca. 4 cm djupt och håll en temperatur kring 25°C under groningen.
	Beans, Fava, Cold-Weather	**0,95**	9,0	4,1	0,4	162	357	139	36,0	16,3	1,6	320	30	122	direktsådd	??	De stora platta fröna kan sås tidigt på våren, så snart jorden reder sig, ca. 5 cm djupt.
	Sunflower	**0,05**	5,0	2,3	0,0	2 585	5 699	65	40,0	18,1	0,1	248	1	5	direktsådd	v. 19–22	Såtid: förkult. i april eller direktsås i maj
30% Calorie	**Potatoes, Irish**	**2,50**	200,0	90,7	22,7	349	769	17 450	0,0	0,0	0,0	248	62	248	direktsådd	??	
	Leeks	**0,40**	480,0	217,7	8,7	277	611	5 318	15,0	6,8	0,3	621	25	**99**	**Nibble**	v. 19–24	Utplantering: maj - början av juni
	Garlic	**0,10**	120,0	54,4	0,5	676	1 490	811	15,0	6,8	0,1	1343	13	54	direktsådd	??	
10% Vegetable	**Kale**	**0,75**	114,0	51,7	3,9	227	500	1 941	0,0	0,0	0,0	84	6	**25**	**Nibble**	maj v. 21–22	Såtid: april-slutet av juni
	Squash, Hokkaido	**0,20**	150,0	68,0	1,4	195	430	585	0,0	0,0	0,0	53	1	**4**	**Nibble? el. direktsådd**	maj v. 21–22	Såtid friland: slutet av maj
	Beans, Snap, Pole	**0,05**	72,0	32,7	0,2	141	311	51	0,0	0,0	0,0	1 343	7	27	direktsådd	juni	
	Total:	10,0		Total:	39,3		Total:	31 990		Total:	15,7						
	Goal:	10,0		Total, per day:	4,3		Total, per day:	3 506		Goal:	13,6						
				Goal, per day:	<2,5		Goal, per day:	**2 000**									
				Per day, adjusted:	2,5		# beds, adjusted:	22,8									

Appendix E: Project Flyer

May 2014

Student project

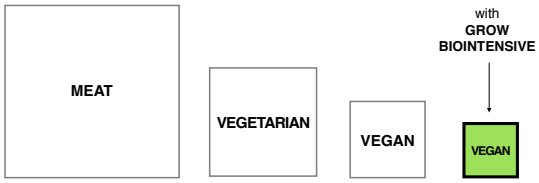
Biointensive mini-farming

GROW BIOINTENSIVE® Sustainable Mini-Farming är en metod för småskalig ekologisk grönsaksodling på ett hållbart sätt. Metoden utvecklades i Kalifornien och har använts i Latinamerika och Afrika under de senaste 40 åren.

GROW BIOINTENSIVE® Sustainable Mini-Farming is a system for growing more vegetables in a small space, organically and sustainably. Learn more at www.growbiointensive.org.

Benefits

With GROW BIOINTENSIVE, it is possible for one person to grow all of their own food (a complete vegan diet) in the area the size of a yard or large garden, without depleting the soil nor bringing in fertilizer/manure.



4000 m² per person | **1600 m²** per person | **800 m²** per person | **400 m²** per person

By concentrating production to a size that's manageable by hand, GROW BIOINTENSIVE uses **less water**, **less fertilizer**, and **less energy** compared to standard agricultural practices.

History

- In the 1960s, English master gardener Alan Chadwick, a student of Rudolf Steiner, combined Biodynamic agriculture and French intensive gardening and brought it to Northern California.
- In the 1970s, John Jeavons at the non-profit organization Ecology Action further developed Chadwick's method, eventually becoming GROW BIOINTENSIVE® Sustainable Mini-Farming.
- Through the 1980s and 1990s, the Biointensive method spread across the world, including to Latin America, Kenya, India, and Russia.

Principles

GROW BIOINTENSIVE IS HIGHLY INTENSIVE ORGANIC FARMING…

- **Deep Soil Preparation.** Double-dug beds, with soil loosened to a depth of 60 cm, aerate the soil, facilitate root growth, and improve water retention.
- **Intensive Planting.** Close plant spacing is used to protect soil microorganisms, reduce water loss, and maximize yields.
- **Companion Planting.** Companion planting facilitates the optimal use of nutrients, light and water, encourages beneficial insects and creates a vibrant mini-ecosystem within the garden.

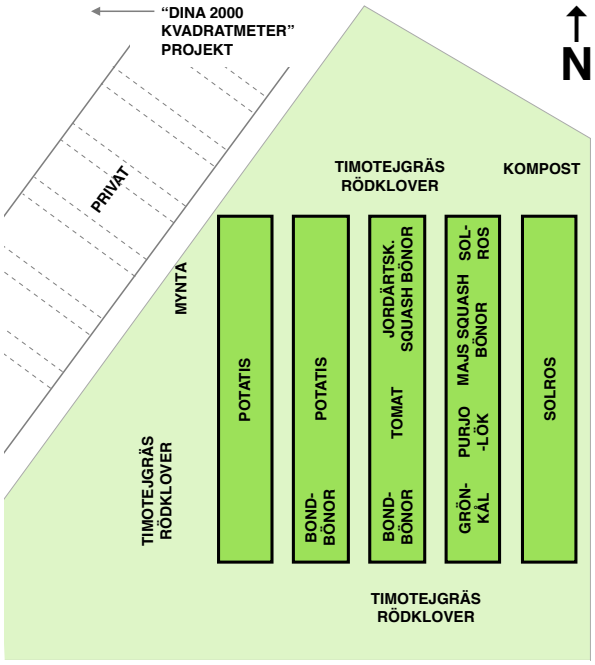
… WITH EMPHASIS ON SUSTAINABILITY AND SELF-SUFFICIENCY.

- **Carbon & Calorie Farming.** Balanced production of calories for the farmer and carbon for the soil ensures that both the farmer and the soil will be adequately fed.
- **Composting.** The health and vigor of the soil are maintained through the use of compost.
- **Open-Pollinated Seeds.** The use of open-pollinated seeds (as opposed to hybrid or genetically modified) helps to preserve genetic diversity and enables gardeners to develop their own cultivars.

All of the above components must be used together for optimum effect and to avoid depleting the soil.

www.biointensiv.se/jarna 2014

Project Flyer (cont'd)



Project notes

- Corn, sunflowers, fava beans, timothy grass, and red clover provide large amounts of biomass, which will be used to feed the soil via compost (as well as provide some food).
- Potatoes, leeks, and Jerusalem artichokes are calorie-efficient crops, providing large amounts of calories in a small area.
- Corn, squash, and beans are companion plants that Native Americans traditionally grew together. Together, they are known as the Three Sisters. We are also trying an adaptation for Sweden using Jerusalem artichokes instead of corn.
- To minimize plants from shading each other, the beds are aligned north-south, and taller plants are placed at the north end.

Public events

- **Work days.** On most Saturday afternoons, from 1–5 PM, join us for digging, planting, weeding, and knowledge exchange. No experience necessary. Check www.biointensiv.se/jarna for the most up-to-date schedule.
- **Guided tours.** Free tours are scheduled 12/7 (Summer of Soil), 2/8, 31/8 (Smaka framtiden), and 6/9, all 1:00–1:30 PM. Meet at the site.

Contact

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The project site is located at
Trädgårdsparken Kulturcentrum Järna
(behind "Dina 2000 kvadratmeter")
GPS 59.068793,17.620322

Studie främjandet

TRANSITION NETWORK OMSTÄLLNING JÄRNA

SMAKA FRAMTIDEN!

Trädgårdsparken Kulturcentrum Järna

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