ABSTRACT: An efficient and ecologically sustainable food production system, GROW BIOINTENSIVE® Sustainable Mini-farming, has been developed and tested over four decades. GROW BIOINTENSIVE® (GB) has effectively demonstrated its resilience in the face of weather extremes around the globe and its ability to rebuild vital soil health. This system employs on-site fertility production, uses 67%-88% less water and 94%-99% less energy than conventionally grown food while sequestering carbon in the soil to reduce greenhouse gases. In addition to a 4000 square foot complete diet model, a nutritionally sensible "survival" diet has been developed to produce 1600 calories/day in as little as 800 square feet with water-efficient crops to address the growing population of people who have limited access to land and water. Data on yields, water use, energy inputs, and soil building acquired over 45 years of implementation of this method is compared and contrasted with other agricultural methods. Already being applied in 151 countries, sustainability metrics indicate its viability for feeding the billions while rebuilding health of people, communities and our life-sustaining eco-systems.

**The Issues**

**Declining Water, Limits of using Fossil Fuel inputs and Declining Area of Farmlable Land**

Food Growing Areas for the People’s Annual Diet

<table>
<thead>
<tr>
<th>Food Growing Areas</th>
<th>Flowering Vegetables</th>
<th>Root Crops</th>
<th>Total Area</th>
<th>Yield</th>
<th>Area/Year</th>
<th>Energy/Bed</th>
<th>Water/Bed</th>
<th>Other Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>1 calorie/kg</td>
<td>2.5 kg/kg</td>
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**Factors that Reduce Water Requirements**

- Optimized close offset spacing of plants forms a "living mulch"
- Sufficient "Soil Organic Matter" (SOM) from roots and compost
- Proper balanced soil nutrients so they are bioavailable to plants
- Planting "water-efficient" crops: high calorie output per gallon

**Performance & Sustainability**

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<tr>
<th>Best</th>
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**Energy Comparisons**

- Example: Energy Ratio for producing onions or corn (for flour)

**The Role of Roots and Soil Depth**

Example: Given good soil, beet roots will grow down 10 feet or more! Vegetables that do not require deep roots are lettuce, kale, and spinach.

**Climate Resilience**

- Deeply rooted plants hold soil in place during heavy rains or floods.
- Deeply prepared soil with high SOM holds moisture in times of drought.

**CompostPower**

- Enhanced using a "cold composting" process, carbon nitrogen ratio of 44:1, structural cellulose/lignin rather than metabolic (sugar) starches form of carbon, properly maintained.

**The Issues**

**Principles of the Method**

1. Deep soil bed preparation (“double dug”)
2. On-site fertility using compost and cover crops
3. Intensive close-space planting (optimized hexagonal close-spaced)
4. Companion planting in space and time
5. Carbon & Calorie Crops to feed soil and people
6. Special high-calorie production unit of area and time root crops
7. Open-pollinated seeds
8. A whole system: essential to practice correctly to build soil

**GROW BIOINTENSIVE** sets standards to ensure sustainability

**GB – 10 Rule for Feeding People and Soil in the Smallest Area**

- 60% of grow area-time: grow carbon and calorie crops
- 30% of grow area-time: grow high calorie root crops
- 10% of grow area-time: grow vegetables for vitamins and minerals

**Declining Water, Limits of using Fossil Fuel inputs and Declining Area of Farmlable Land**

Food Growing Areas for the People’s Annual Diet Using Different Agricultural Techniques

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**Economics, Environment and Sustainability**

10% Rule for Export

- GB advocates closed-cycle practices as much as possible to indefinitely sustain the system’s nutrients, but crops produced from up to 10% of the cultivated area can be exported for income without significant detriment to the system.

- With a carefully targeted market, the high quality and yields from GB production have been used to generate high income from small area.

- In developing countries, families practicing GB are providing for their own food needs, significantly improving their health and quality of life while also generating income.

**Time Commitment for Practice**

- Once the initial bed preparation has been completed, food growing and bed maintenance of a 2100 sq. ft. farm can require as little as a small fraction of a day, averaged annually, depending on the crops chosen, soil and climate.

**Examples of Implementation**

- Mexico’s Ministry of Social Security selected GB after a 3-year evaluation compared with 5 different methods to use to train patients who come to the rural health clinics how to be proactive in their health by growing and eating healthier foods. GB is demonstrated on site at the clinics.

**The Tuscani Women’s Group near Thika, Kenya use GB to support/train and improve the health of widows and orphans affected by HIV/AIDS.**