Building Soils Using BioIntensive Techniques

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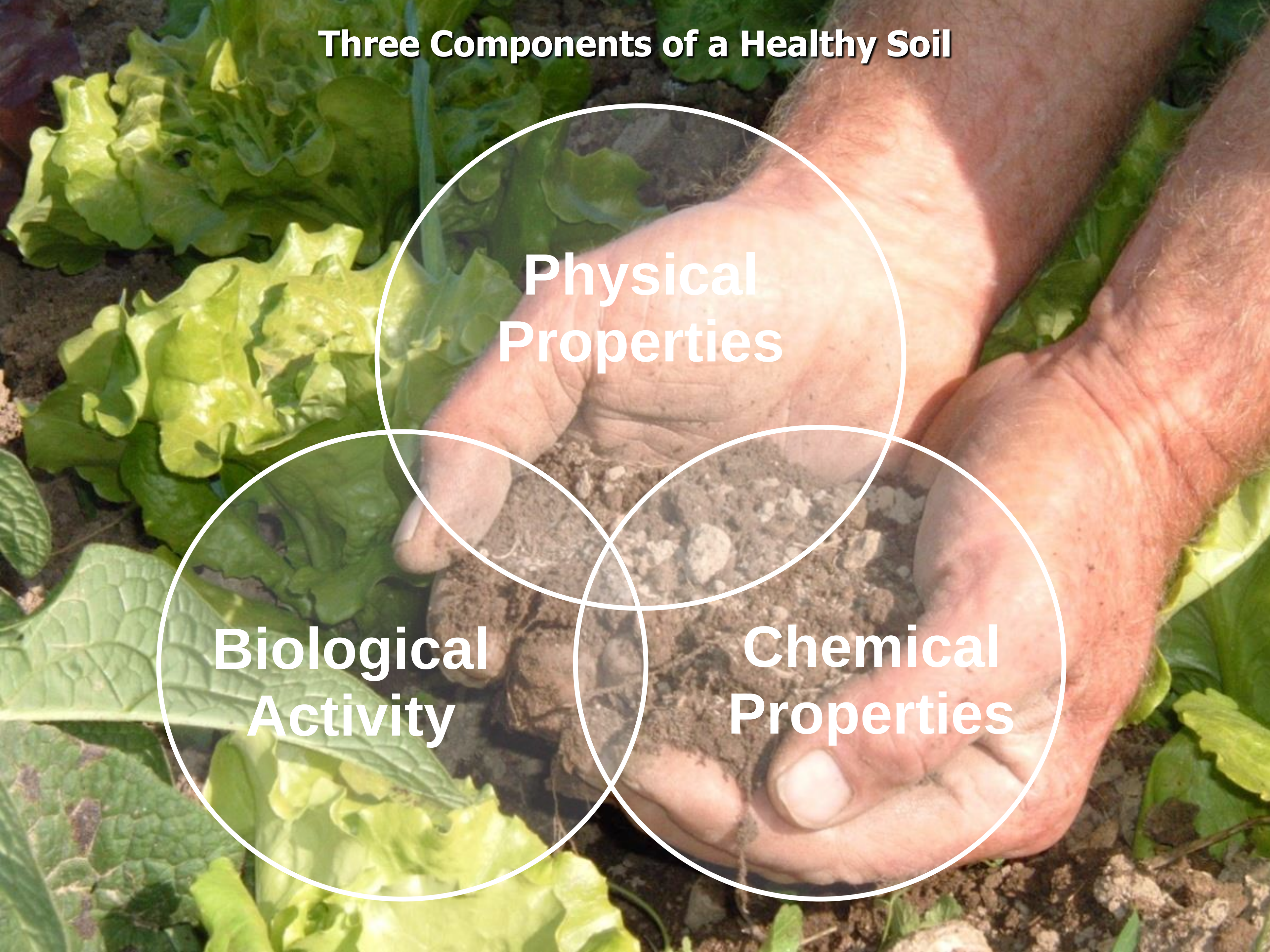
Promoting excellence in food security programming

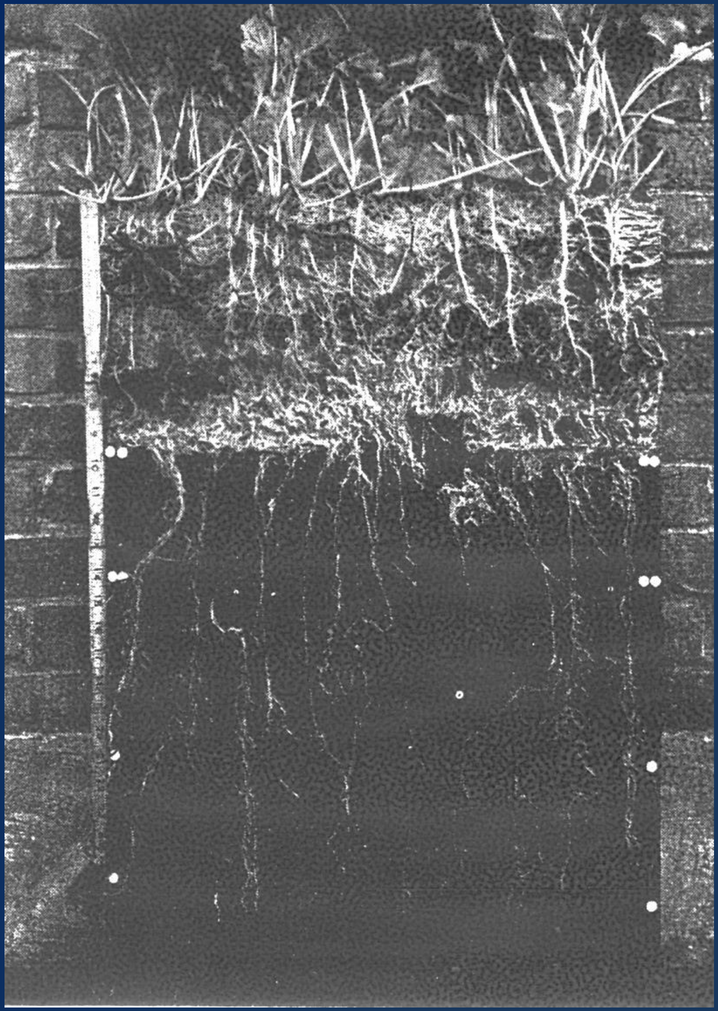

Three Components of a Healthy Soil
Physical Properties
Biological Activity
Chemical Properties

Anthropogenic and natural synergies in soil improvements

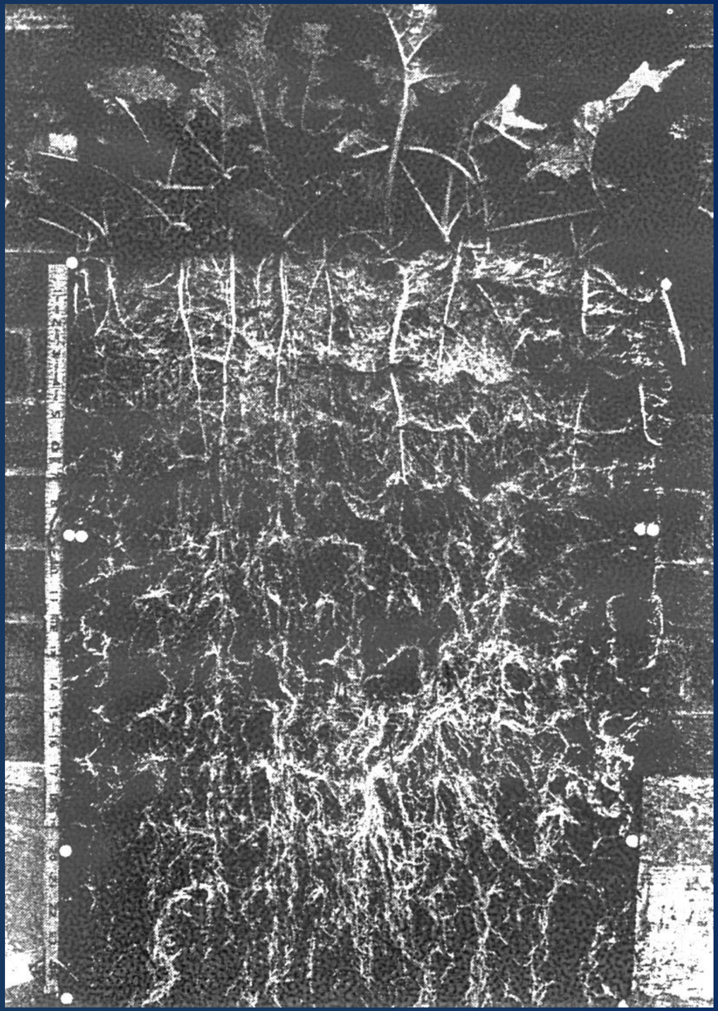
- Avoids soil compaction (Pathways and beds)
- Deep soil development
    - Create AWOM
    - Rhizosphere development
    - Sequestration of Carbon
    - Water storage
- Reduced soil erosion (water and wind)

Soil Development

- Create a microclimate with dense plant spacings
  - Protect soil organisms
  - Control heat movement in the soils
  - Increased CO_2 outgassing for plant utilization



Most of the roots of these plants (rape - *Brassica napus* var. Dwarf Essex) are confined to the topsoil, the result of badly restricted root space due to a compact subsoil.



Here’s how the roots of rape plants will grow when given a chance. Soil in which these plants were grown had been loosened 20 inches deep by hand with a fork. One requirement for a bountiful harvest is profuse uninhibited root development.

Techniques to increase both quantity and quality of compost and therefore Increasing SOM/SOC

5 elements of design in compost and humus production:

- Yields
- Cold Composting
- Carbon to Nitrogen Ratios
- More structural and less metabolic carbon
- Correct maintenance

Cold Composting

- Slightly more carbonaceous material and/or less nitrogenous material
- More course materials and less fine ones
- Slightly more soil when building pile
- Slightly more water when building pile
- A ‘no turn’ approach

Carbon/Nitrogen Ratio of 30/1, 45/1 and 60/1

In preliminary studies the 45:1 cured compost consistently produced higher yields of grain and biomass than either of the other two.

More Structural Carbon

- Building a pile which uses *more* ***structural carbon***, such as cellulose and lignin (mature straw and stalks) and *less* **metabolic carbon** (such as sugars and starches) may produce a more durable, lasting cured compost

Correct Maintenance

- A cured compost pile that has been ***properly maintained*** can contain 20% or more organic matter rather than the more typical 8% to 10%.

Diagonal off-set close spacing under this technology increased the maize grain yield of both varieties 1.3 times

Yields of both varieties were about twice the published potential yield of improved hybrid maize (6 tons ha-1) grown with conventional practices

Table 6. A comparison of revenue, gross margin, and benefit/cost ratio of growing 'Hybrid 614D' and 'Number 8' using low cost BIA techniques at two different plant spacing at MHAC near Kitale, Kenya, 2013.

Maize variety	**Revenue**	**Gross margin**	**Benefit/Cost ratio**
		KES/9m^2 plot	
Namba Nane	367.7^{a}	147.2^{a}	1.67^{a}
Hybrid 614D	294.5^{b}	69.68^{b}	1.31^{b}
P value	*0.11*	*0.095*	*0.089*
Spacing (cm)			
38 by 38	380.2^{A}	154.15^{A}	1.69^{A}
75 by 30	282.0^{B}	62.73^{B}	1.28^{B}
P Value	*0.041*	*0.054*	*0.054*

Means within a column followed by the same letter are not significantly different (LSD, $\alpha = 0.05$).


2 1 2002


2 1 2002


2009

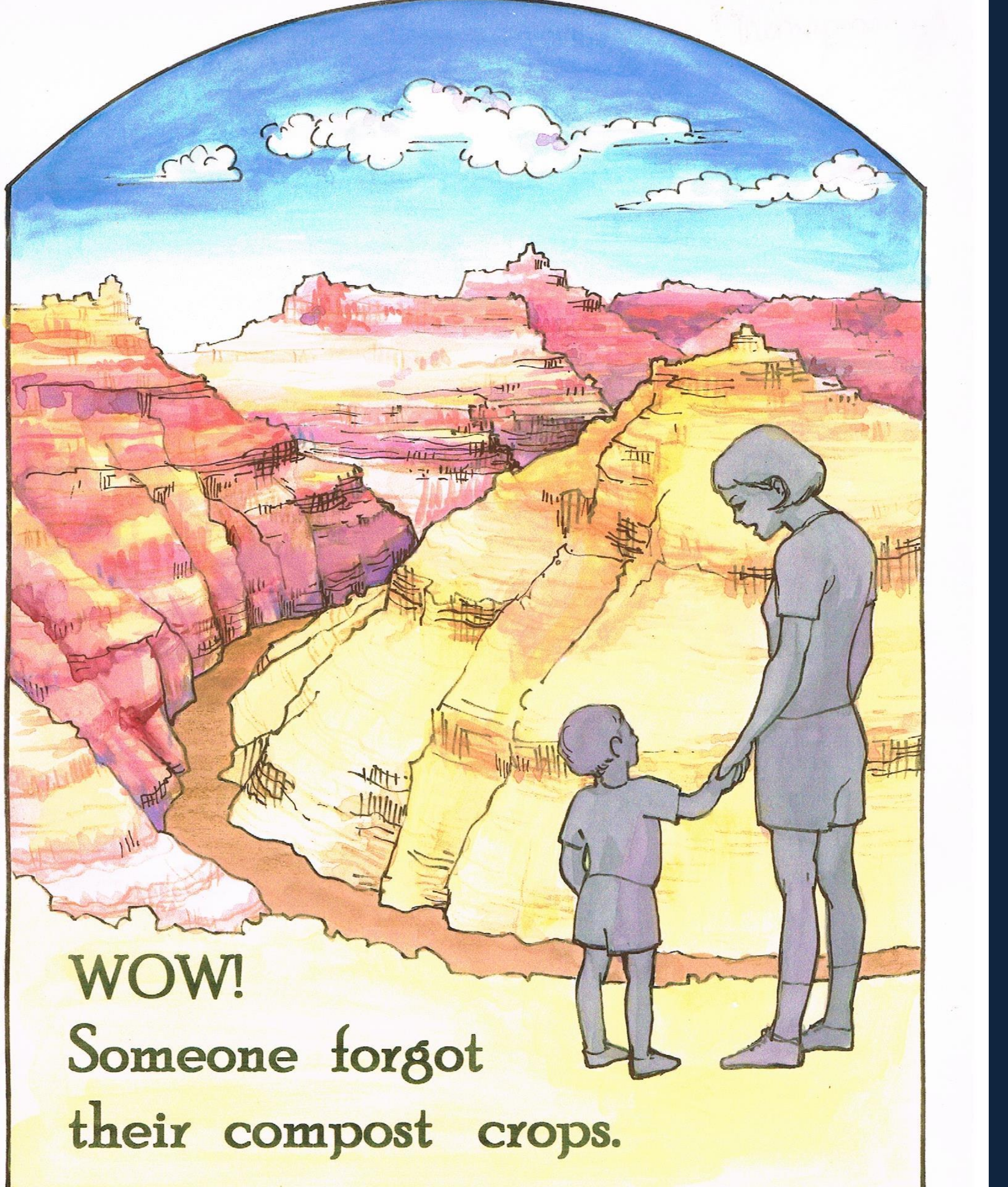
Chemical Soil Changes over 7 Years of BioIntensive Production in Aguascalientes, Mexico

Chemical Properties	Years							
	0	1	2	3	4	5	6	7
OM%	1.4	1.5	1.7	1.2	3.1	3.9	3.1	3.8
CIC meq/100grs	14.5	20.8	17.9	18.7	19.2	19.4	17.2	17.9
pH	7.9	8.1	7.8	7.5	7.7	8.1	7.5	7.8
Ca %Sat	57.1	58.9	60.2	65.2	67.4	70.9	69.2	69.8
Mg %Sat	34	30.3	27.6	25.1	22.3	16.7	17.2	17.8
K %Sat	6.2	6.6	6.2	5.5	6.4	7	7.3	8.7
Na %Sat	2.6	4.2	4	4	4.7	5.6	6.3	3.6
Ca ppm	1650	2450	2420	2440	2570	2750	2655	2500
Mg ppm	590	755	654	564	486	388	355	383
K ppm	352	535	478	401	467	533	492	609
Na ppm	88	201	220	172	212	252	250	149
N ppm	14.25	14.75	13.5	12.5	19.25	26	19.5	51
P available ppm	8	22	21	17	35	53	48	82
P in reserve ppm	14	54	62	68	113	159	121	180
S ppm	7	24	47	149	108	68	82	27
Zn ppm	1.2	3.1	3	2.9	9.8	16.8	14.9	17.6
Mn ppm	27	55	47	37	48	59	63	55
Fe ppm	16	21	20	22	21	22	22	21
Cu ppm	2.4	3.2	3.1	2.8	2.6	2.5	2.7	3.2
B ppm	0.4	2	1.8	1.5	2.2	2.9	2.2	1.6

Fertilizer	Years of application							
	2007	2008	2009	2010	2011	2012	2013	2014
Compost Vol. ls/m^2	6.26	8.35	10.43	12.52	14.61	12.52	12.52	15.20
Compost kg/m^2	2.82	3.76	4.70	5.63	6.57	5.63	5.63	6.57
Gypsum kg/m^2	0.20	0.33	0.31	0.09	0.10	0.00	0.00	0.16
Elemental Sulfur kg/m^2	0.00	0.10	0.10	0.00	0.00	0.12	0.05	0.00
Phosphoric rock kg/m^2	0.30	0.24	0.24	0.15	0.15	0.10	0.10	0.08
Alfalfa Meal kg/m^2	0.37	0.35	0.33	0.33	0.31	0.21	0.21	0.11

Annual Production of Food and Compost Materials

Production	Years of production							
	2007	2008	2009	2010	2011	2012	2013	2014
Edible yields kg/m^2	1.957	2.207	2.167	1.939	2.303	2.480	2.588	2.659
Inmature materials kg/m^2	1.774	2.365	2.174	1.774	2.240	2.517	2.645	2.733
Mature materials kg/m^2	0.557	0.677	1.449	0.646	1.492	1.635	1.705	1.781
Total biomass/dry kg/m^2	1.378	1.655	2.273	1.463	2.515	2.617	2.766	2.827


WOW!
Someone forgot
their compost crops.