BIOCHAR SOIL IMPROVEMENT

WHY BOTHER? WHAT CAN IT DO FOR YOU? HOW DO YOU MAKE IT?
YOUR MOST VALUABLE ASSET IS YOUR SOIL
BUT WHAT’S THE REAL TRUTH ABOUT FARMING IN NORTH THAILAND?

Our soils are terrible. They are…

- Nutrient Poor
- Compacted
- Poor at Water Absorption/Water Retention
- Too Acid (Very Low pH)
- Deficient in Organic Matter
- Dead with No Soil Life – Microbes, Fungi, Worms
### WHAT NUTRIENTS ARE MISSING?

#### Big 3 Macronutrients
- N nitrogen
- P phosphorous
- K potassium

#### 2nd Tier Macronutrients
- Ca Calcium
- S Sulfur
- Mg Magnesium

#### Key Micronutrients
- B Boron
- Cl Chlorine
- Mn Manganese
- Fe Iron
- Zn Zinc
- Cu Copper
- Mo Molybdenum
- Ni Nickel

*Our soils are lacking in all of them!*
Chemicals are expensive and 50%+ wash away in the first rain.

Standard NPK does not supply the other required macro- or micro- mineral nutrients.

What if you had to live on a diet of eggs, rice and bananas?

Minerals are only half of what a plant needs to eat. The other half - organic matter - cannot be supplied by synthetic fertilizers.

Chemicals do not solve any of your other problems.
WHAT ARE YOU DOING ABOUT THE OTHER PROBLEMS?

- Plowing To Break Up The Soil
- Maybe Liming
- Irrigating
SO WHAT’S WRONG WITH THAT?

- Plowing creates deep compaction that roots cannot penetrate
- You have to lime every season because the lime only works for a little while and runs off with the rains
- You have to use a huge amount of water because much of it runs off the hard surface of your soil and never soaks in – and when it runs off, it takes a lot of your fertilizer with it
Used Properly, Biochar Can:

- Improve soil structure
- Improve water penetration
- Improve water retention
- Increase pH (make your soil less acid)
- Increase soil life (microbes, fungi, worms)
- Increase organic matter (the other half of plants’ diet)

And…

- It’s free
- You can make it yourself
WHY NOW? CLIMATE CHANGE AND YOU

What’s happening to the weather? What’s happening to the rainy season? What’s happening to the rains?

- The weather is getting hotter.
- North Thailand is getting drier.

The rainy season is getting later and less predictable.

- When rain falls we get big storms and floods that rush off down the river leaving nothing behind in the ground.

These conditions will continue to get worse and worse.

- If we do not change how we farm now, climate change will soon destroy agriculture in North Thailand
Thailand just joined ASEAN.
- Thai farmers make less money for every ton of rice or fruit or vegetables they raise than farmers in any other ASEAN country.
- Why? Because you spend so much money on chemicals!
WHY NOW? – YOUR MONEY

- A woman I met in MaeJo is selling compost for 30 THB per kilogram.
- At this price you can sell biochar for at least 30,000 THB per ton.

Think about it.

- Our training is about stopping smoke.
- But this is about why stopping the smoke is not a burden, it is a business opportunity for…
  - Farmers
  - House wives
  - Tambons
  - Clinics

If you have leaves, straw, stalks, wood chips, etc, you can make biochar and make money.

This is different from the usual anti-smoke training.
What is the problem?

- Our soils are mostly clay
  - They are dense, heavy when wet, hard when dry
  - Water just runs off when it rains or we irrigate

Result?

- Poor water penetration.
- Poor fertilizer penetration.
- Poor water retention.
- Floods down stream.
- No water early in the dry season, poor crop growth.
Biochar added to soil, even clay, makes the soil more porous

- Water will penetrate porous soil more easily

Water runs off hard packed clay

Water penetrates easily where biochar particles have made spaces

Biochar in soil will absorb lots and lots of water

- Wet biochar holds enough water to add two extra days between waterings
pH measures how acid your soil is.

pH runs from 1 (acid) to 14 (alkaline).

A pH of 7 is neutral and most plants like soil that is around pH 7.

They grow best at pH 7 because all of the nutrients in the soil are available to them.

Our soils are very acid – pH 4.5 -5.5.

In acid soils the most important nutrients are not available to plants.

SOIL pH AND YOU

<table>
<thead>
<tr>
<th>pH 7</th>
<th>Very Little N, P, K, S, Ca, Mg</th>
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<tbody>
<tr>
<td>pH 4.5 – 5.5</td>
<td>Our Soil pH 4.5 – 5.5</td>
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Biochar has permanent pH of 8

Adding biochar raises soil’s pH in the direction of 8

Raising the pH unlocks access to many nutrients in soil

We will teach you how to make biochar fertilizer with pH 10!
Healthy soil is alive with microbes, fungi and worms

- Live soil feeds your plants

Plants cannot eat N, P, K or other mineral nutrients; they need soil life to eat them first – then pee!

- You plants take up bug pee

Soil life needs oxygen

- Worms and fungi open the soil to let the air in
BIOCHAR AND SOIL LIFE

- Tiny holes in the surface of biochar make nice condos for soil life.
- The minerals on the surface of biochar particles attract many types of soil life.
- Microbes colonies that develop around biochar particles control the growth of microbes that make plants sick.
- The microbes and fungi attract worms that make holes in the soil to bring oxygen underground.
SOIL ORGANIC MATTER AND YOU

- Organic matter is dead stuff, plant or animal, that is rotting.
- Organic matter provides food and living space for microbes, fungi and worms.
- The microbes, fungi and worms turn organic matter into food that your plants can take up.
- Organic matter should be 2-10% of soil; not less than 1.3%.
- Our soil typically has less than 1.3%, often less than 1%.
Where we live organic matter rots quickly because in the heat the microbes and fungi grow rapidly and eat fast.

With rapid decomposition, much of the potential nutrition is lost before plants can take it up.

When the organic matter is gone, more must be added to the soil or the soil (and plants) will die.

But if we have mixed biochar into the compost and soil the nutrients stick to the biochar and stay.
Biochar itself is NOT fertilizer. In fact, if you put it into your field right after making it, your plants may die.

**ALWAYS** – always age your biochar for at least three months before you use it.

Biochar to **IMPROVE SOIL** – To get the biggest effect from your biochar, mix it with what your soil needs. The biochar will make it better and it will make the biochar better.

- Pour as much pig pee on your biochar as it will absorb. (If you do not have pigs, any kind of pee will do, even yours!)
- Mix biochar, good compost and manure 1:1:1 (If you do not have compost or manure, substitute the other.)
- Spray well with EM and mix, spray again and mix again
- Cover the pile and let it sit for 3 months.
USING BIOCHAR TO IMPROVE SOIL

- **Potting mix** – add a few handfuls to your normal recipe (Do not overdo it. Biochar retains a lot of water and if you are not careful you will have problems with damping off.)

- **Planting seeds** – make hole, add small handful of biochar mix, cover with dirt, place seeds, cover with dirt, sprinkle a small handful of biochar fertilizer on top

- **Planting seedlings or trees** – dig large hole, replace one half of the dirt with biochar mix, toss 2-3 handfuls of biochar mix at the bottom of the hole, plant

- Planting rice, each rai:
  - **Nursery bed** – mix 5 kg of biochar mix into mud at least 2 weeks before planting seeds
  - **Paddy** – mix 800 kg of biochar mix into mud at least 2 weeks before replanting for four years (benefits in year 1)
  - **Orchard trees** – spread 10 kg of biochar mix in a shallow trench around tree at the “drip line”, cover with dirt, repeat every 3 months
BUT DOES IT WORK?

Biochar alone  No fertilizer

Biochar + NPK  No fertilizer

NPK alone  Biochar + NPK

Biochar alone  NPK alone
Biochar is a simple way to enrich your soil.

In the short-term and increasingly over the long-term, it will improve your yields.

It will improve your soil in every way and will help to prepare you for the risks of climate change.

Used properly and regularly, biochar can help you:
- Manage your water needs better;
- Reduce your costs; and
- Improve your yields and income.
BIOCHAR IS NOT MAGIC...

But it’s better than anything else!

Biochar Takes Work But It Will…

- Pay you for your work.
- Make you and your family healthier.
- Ensure that your land will remain productive into the future.
CONTACT INFORMATION

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