SOIL FERTILITY

BY.....

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OBJECTIVES

1) To equip the participants with practical knowledge and skills on soil fertility products
2) To promote effective use of biofertilizers
3) To provide farmers/participants practicing organic Agriculture with soil amendments made from locally available raw materials

BENEFITS OF DOING BIO-FERTILIZER AT HOME

- LOW INVESTMENT (INGREDIENTS & EQUIPMENTS}
- EASY TO GET INGREDIENTS (EVEN FOR FREE}
- COMMON SENSE TECHNOLOGY
- POSIBILITY TO COMBINE WITH OTHER LAND MANAGEMENT

STATUS OF OUR SOIL

- **Acidic-poor PH**
- **Poor soil structure**
- **Poor aeration**
- **No soil life- microbes**

Hence low productivity in our farm that leads to food insecurity

SOIL-A living organism

- ....and therefore in a continuos process of transformation
- Soil is very diverse and complex full of live

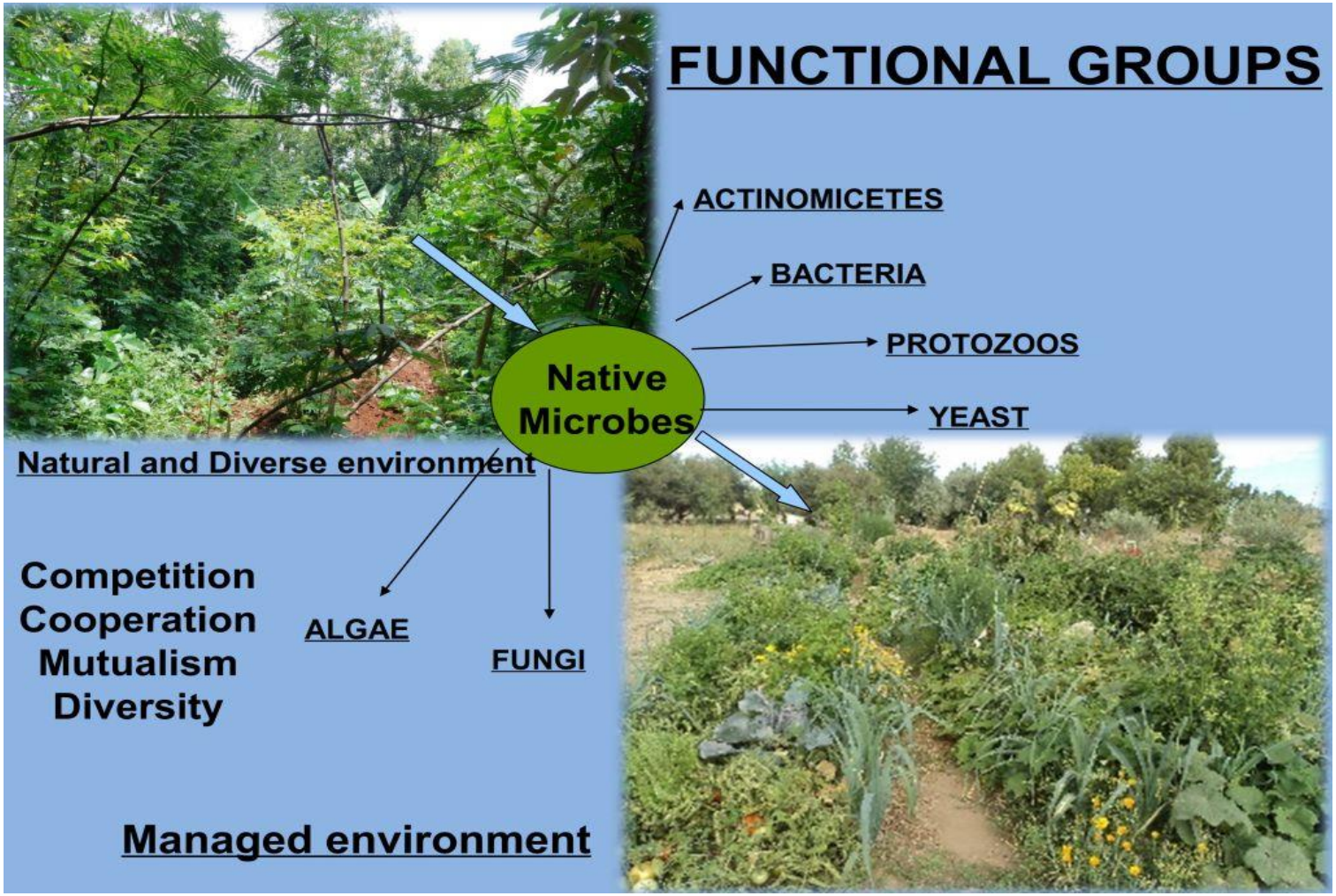
- Its a habitat for plants ,animals and micro-organisms which are all interlinked with each other

FOR MAXIMUM PRODUCTION

- SOIL MUST HAVE.....
  - *–ORGANIC MATTER*
  - *–MINERALS*
  - *–MICROBES*

NATIVES MICROBES

MICROBES


FUNCTIONAL GROUPS
ACTINOMICETES
BACTERIA
PROTOZOOS
YEAST
Native Microbes
Natural and Diverse environment
Competition
Cooperation
Mutualism
Diversity
ALGAE
FUNGI
Managed environment

What Microbes need??

Medium to **LIVE** in *(House)*

FOOD as healthy diet

....then they will do the **WORK**!!!

NUTRITION

Microbes need a healthy diet!!!

Carbon.- Energy source & build structures
Nitrogen, Oxygen and Minerals.- to perform different processes
Vitamins.- As a supplement in the diets (Vit.B)

HOUSE

Medium to grow.- Liquid - Solid

Presence/Absence O2.- Aerobic - Anaerobic

Warm Temperature.- 20ºC-30ºC

Ultraviolet incidence .- Low incidence

THEY PERFORM IN A WIDE RANGE OF CONDITIONS DEPENDING OF ENVIRONMENT

Some Functions of Native Microbes:

- **Decompose** Organic Matter to create Humus
- Make Minerals **available** to plants
- **Use products** of other organisms (Sugars, amino acids, enzymes, alcohol, acids…)
- **Symbiosis** (working together)
- **Prevent** pests and diseases

MINERALS

Source of minerals

Originate from sub soil and rocks through weathering

Rocks particles contain.....

- Minerals that are slowly released to plants

-

- Micro-organisms actively dissolves nutrients from mineral particles

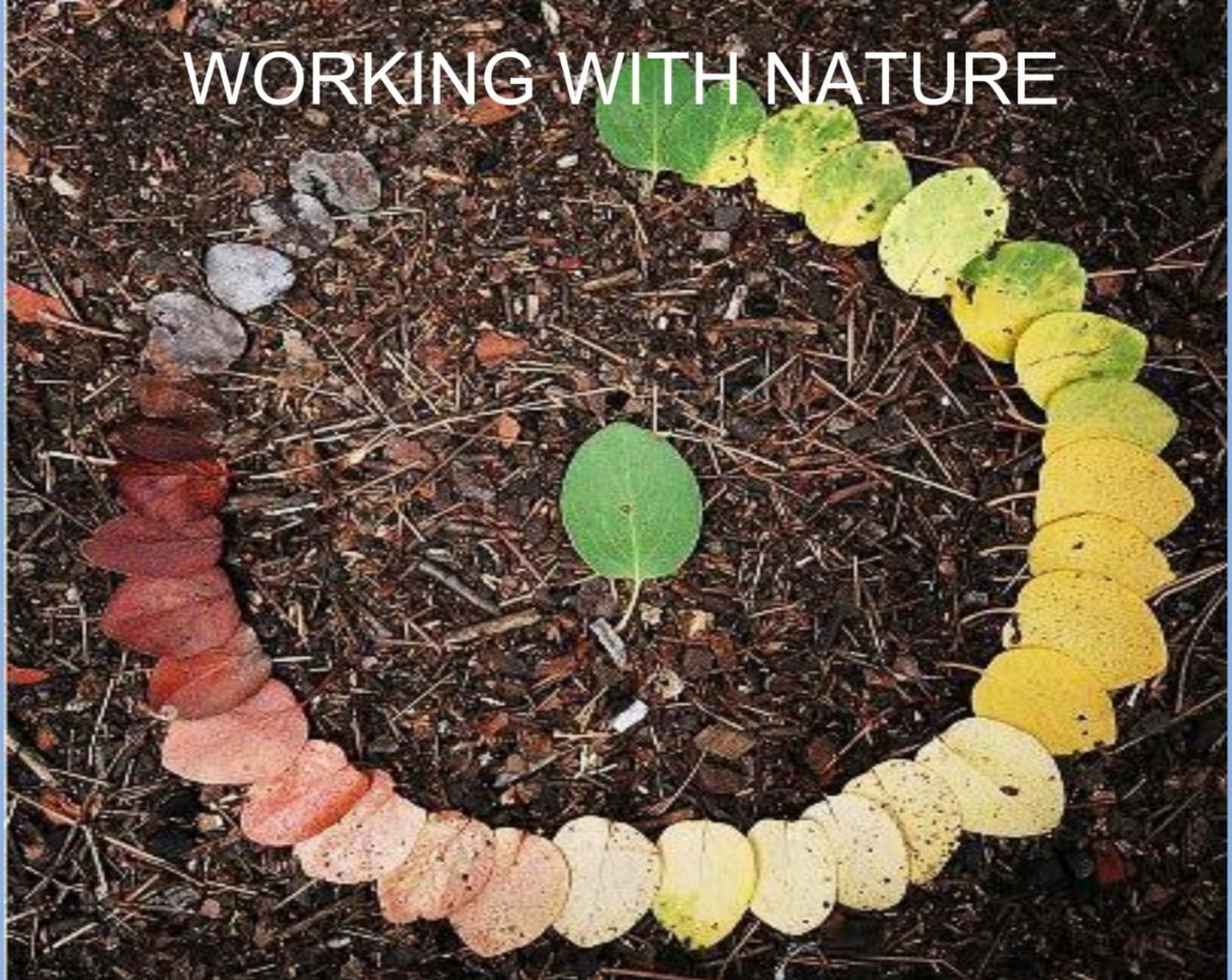
Plants needs minerals to build up organic matter and for physiological processes

ROCK IN DIVERSE COLOUR

Rock Dust

SOIL ORGANIC MATTER

WORKING WITH NATURE



WHY ORGANIC MATTER IS SO IMPORTANT ?

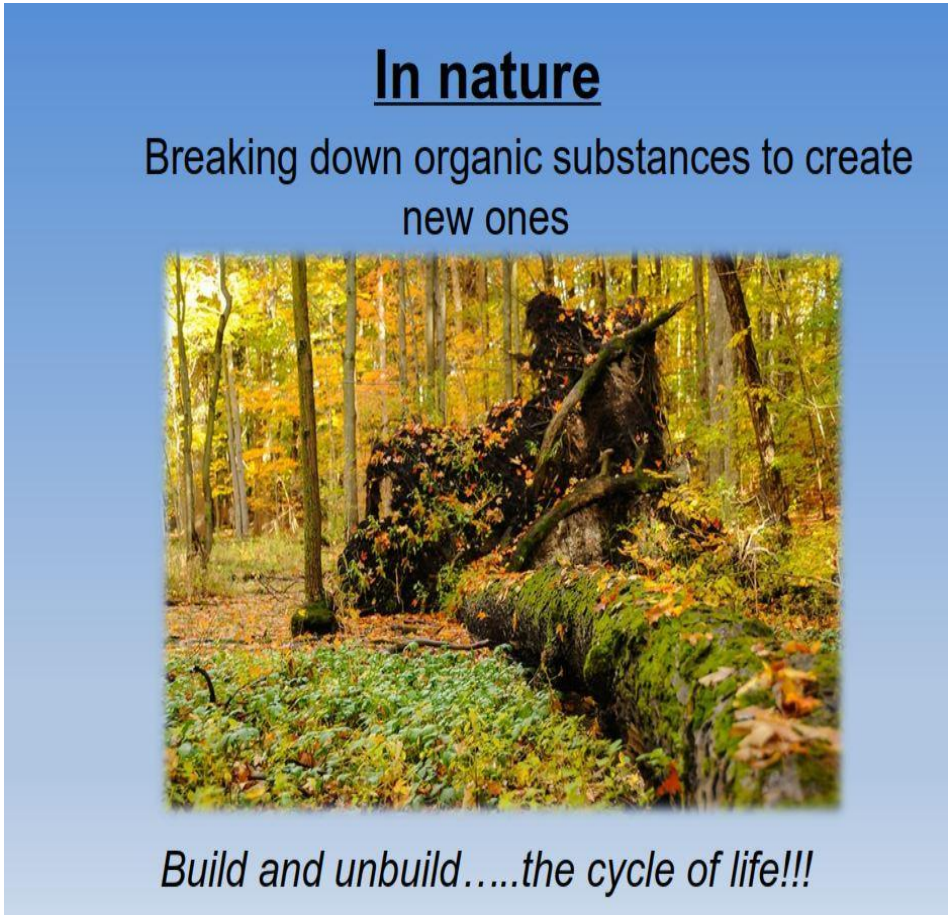
- O.M has great capacity to retain nutrients and release them continuously

- O.M holds water up to 5 times their own weight
- (acts like a sponge)

WHY ORGANIC MATTER IS SO IMPORTANT ?

- O.M acts like a glue-sticking soil particles together thus forming stable crumbs

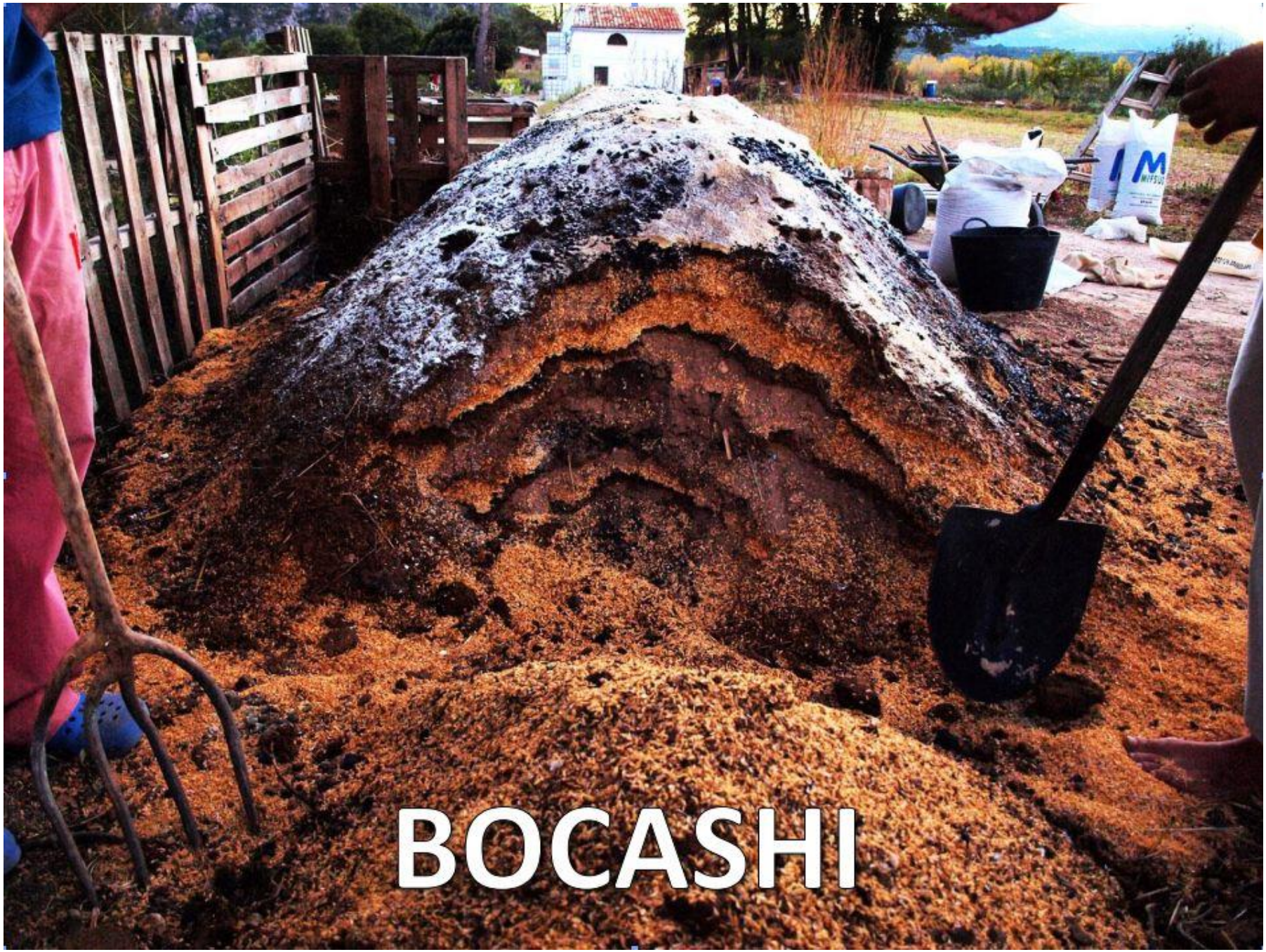
- Beneficial micro-organisms feeds on organic matter thus releasing nutrients



WHY ORGANIC MATTER IS SO IMPORTANT ?

- O.M improves soil structure

- O.M reduces soil acidity


BOCASHI

JAIRO $ JUAN

BOCASH –

Mean-precooking the organic matter on its own steam, taking advantage of heat generated by their aerobic fermentation

FARMERS NEED TO KNOW....

- Micro-organisms bring life and mobilize the nutrients found in the soil to deliver them to the plants

- Micro-organisms in the soil release or send only the nutrients the plants needs.

DISTRIBUTION OF THE MASS OF MICRO-ORGANISMS IN THE SOIL

GROUPS	TYPES	BIOMASS
MICROBES	BACTERIA AND FUNGI	80%
MESOFAUNA AND MICROFAUNA	NEMATODES,COLLEMBOLA AND ACARI	2%
MICROFAUNA	ENCHYTRAEDAE AND EARTHWORMS	14%
OTHERS	-----	4%

PROCESS TO PREPARE BOCASH-FERMENTED ORGANIC FERTILIZERS

- There are two stages
- 1) stabilization--- temp reach 70*c to 75*c due to increase in microbial activity breaking down of materials
- Then it decrease in the energy source
- MATURING STAGE---Degradation of the organic materials is slower-then bocash reach its ideal state of use.

FACTORS THAT AFFECT PREPARATION OF ORGANIC FERTILIZER

TEMPERATURE

- Temp rise beyond 50° C due to microbial activity which start after mixing approximately after 14 hrs
- This is a good sign to continue with other stages

P H (ACIDITY)

- Rages from 6 to 7.5
- Extreme PH affects microbial activity
- At beginning, PH is low but re-corrects itself with the biological evolution

FACTORS THAT AFFECT PREPARATION OF ORGANIC FERTILIZER

HUMIDITY

- OPTIMUM humidity ranges from50% to 60%
- Under 35% leads toslow aerobic decomposotion
- Over 60% leads to anaerobic process hence rotting of organic matter

AERATION

- Necessary to ensure no limitation in aerobic process

Of fertilizer fermentation.

FACTORS THAT AFFECT PREPARATION OF ORGANIC FERTILIZER

INGREDIENTS PARTICLE SIZE

- Reduction in particle size may have advantage of increasing the area of microbiology decomposition
- How ever very small size may cause compaction which anaerobic process.

CARBON NITROGEN RATIO

- Ideal ratio of preparing fast fermenting fertilizers is 1 to 25—35
- Lower ratios causes nitrogen volatilisation
- Higher ratios causes slower fermentation and decomposition

INGREDINTS TO MAKE BOCASH

Photo charcoal sizes 0.5 to 1.5 cm diameter

1. CHARCOAL

- Improves physical characteristics of soil-structure,and texture
- Helps micro and macro-organisms of multiply --in charcoal

Has a solid sponge type effect that has capacity to retain, filter and gradually reduce useful nutrients from plants thus decreasing their loss and leaching out of the soil

Charcoal allow good oxygenation of the fertilizers

Charcoal is --Thermal regulator for the plant root sysytem- making them more resistant against low temperature at night and provide a cooling effect during hot days

- End product of charcoal provide humus

INGREDINTS TO MAKE BOCASH

2) POULTRY MANURE

- Best is from laying birds
- Provide phosphorous,Nitrogen,potassium,magnesium,iron,manganese,zinc,copper,boron..
- Other manure that can be used include-dung from rabbits, pigs, cows, sheep,
- goats, etc.

INGREDINTS TO MAKE BOCASH

Can be substituted by

Dry and finely shredded straw, decomposing saw dust from trees without tannin/oily or aromatic

Nb when saw dust is used double molasses and yeast

- RICE HULLS OR COFFEE PERCHMENT
- Improves physical characteristic of organic fertilizers facilitating aeration, absorption of humidity, dosage and filtering nutrients
- Helps to increase soil micro-organisms
- Stimulate plants roots development
- Provides phosphorous, silicon and potassium.

INGREDIENTS TO MAKE BOCASH

RICE BRAN, Grain or semolina

Provides Nitrogen and is very rich in complex nutrients when their carbohydrates are fermented

Contain phosphorous,potassium,calcium zinc and magnesium

NB Can be replaced BY WHEAT,MAIZE OR BARLEY BRAN

INGREDINTS TO MAKE BOCASH

Can be replaced by use brown sugar,jaggery,water from coffee fermentation tanks/processing

MOLASSES OR SUGAR CANE JUICE

- Source of energy for microbial activities
- Rich in potassium. Phosphorous and magnesium,
- Micro nutrients-zinc, manganese, iron, copper
- Vitamin B complex

INGREDINTS TO MAKE BOCASH

- **YEAST/VIRGIN SOIL/FOREST DUFF AND BOCASH**
- Source of micro biological inoculation..bacteria.
- Starter to fermentation
- REPLACE By Home made yeast..
- Mix 1.5 kg of maize in pot to geminate or sprout for eight days, with little water covering all the grain. After 8 days ground and ferment again for two days in the same water, add one gallon of water

INGREDINTS TO MAKE BOCASH

- **PLAIN SOIL**
- PROVIDES better physical homogeneity to the fertilizers and distributing its humidity
- Increases volume in which microbiological activity of the fertilizer may exist

INGREDINTS TO MAKE BOCASH

- **AGRICUTURAL LIME /WOOD ASH**
- Regulate the acidity arising during the whole fermentation process
- Depending on its origin, may contain useful minerals

INGREDINTS TO MAKE BOCASH

NB Right humidity is checked by taking a small handful of the mix and squeezing it tightly so no drops of water come out between fingers and crumbly lump is formed in the hand.

ITS BETTER FOR fertilizer to tends towards dry but not very wet

More water must never be added during its processing once bocash is made

- UNTREATED OR SPRING WATER
- Homogenize the humidity of all ingredients
- Encourages ideal conditions for proper performance of the activity and reproduction of microbiology.

SITE SELECTION FOR MAKING BOCASH

Site selection

- Must be protected from sun light, rain and wind-These can affect fermentation process and affect final quality

TIME BEFORE BOCASH IS READY

- Take 15 to 20 days
- within first 5 days turn twice a day
- Later turn it twice a day
- This ensures good aeration AND REDUCTION OF TEMP

BOCASH FOR VEGETABLES AND SEEDBEDS

INGREDIENTS	QUANTITY
POULTRY MANURE	18 SACKS
RICE HULLS/grass/wheat	14 SACKS
SOIL	15 SACKS
RICE BRAN	2 SACKS
MATURE BOCASH	4 SACKS
CHACOAL CRUSHED	6 SACKS
MOLLASES	10 LITRES
YEAST	100 GMS
HUMIDITY (FIST TEST)	35 TO 40 %

BOCASH FOR SEEDS NURSERY

INGREDIENTS	QUANTITIES
SOIL	2 SACKS
RICE BRAN	1 BAG
CHARCOAL DUSTS	1 BAG
POULTRY MANURE	1 BAG
MOLLASES	1 LITRE
Agricultural lime/ash	4 kg
Bakers yeast	100 gms
Water (fist test)	Only once 30 to 40 %

BOCASH FOR RECENTLY TRANSPLANTED VEGETABLE AND SEED BED

INGREDIENTS	QUANTITIES
POULTRY MANURES	20 SACKS
SOIL	20 SACKS
CRUSHED CHARCOAL DUSTS	6 SACKS
RICE BRAN	2 SACKS
MOLLASES	40 LITRES
Agricultural lime/ash	4 kg
Bakers yeast	100 gms
Water (fist test)	Only once 30 to 40 %
NATIVE MICRO-ORGANISM	15 KGS

BOCASH FOR COFFEE FARMERS FORMULA NO.1

INGREDIENTS	QUANTITIES
COW DUNG	1000KG
COFFEE PULP	1000 KG
COFFEE PARCHMENT (CRUSHED)	300KG
YEAST	1.2 KG

BOCASH FOR COFFEE FARMERS FORMULA NO.2

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
POULTRY MANURE	20 SACKS
COFFEE PULP	20 BAGS
YEAST	1 KG
CRUSHED CHARCOAL	3 SACKS
RICE BRAN	1 SACK (50 KG)

BOCASH FOR COFFEE FARMERS FORMULA NO.4

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
POULTRY MANURE	20 SACKS
COFFEE PULP	20 BAGS
YEAST	1 KG

AMOUNT OF BOCASH USED IN DIFFERENT CROPS

CROP	AMOUNT
SSEDLINGS DEVELOPMENT IN TREYS- PLANTING MEDIUM	MIX 80 PART OF SIFTED SOIL WITH 20 PARTS BOCASH 60 PART SITED SOIL TO 40 PART BOCASH
FRUITS TREE BAGGING MEIUM	60 PARTS SOIL TO 40 PART BOCASH
LEAF VEGETABLES	50 TO 80 GRAMS
ROOT VEGETABLES	100 TO 150 GRAMS
VEGETABLES THAT FORM HEADS	200 GRAMS
TOMATOE	125 TO 250 GRAMS
ONION OR CHIVE	25 TO 50 GRAMS
BEET ROOT	100 GRAMS
LETTUCE	50 TO 80 GRAMS
BEANS/ MAIZE	30 TO 50 GRAMS
BRASSICAS	50 TO 80 GRAMS
CUCUMBER	50 TO 80 GRAMS

BOCASH FOR COFFEE FARMERS FORMULA NO.5

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
POULTRY MANURE/COW DUNG --DRY	20 SACKS
COFFEE PULP	20 BAGS
YEAST	2 KG
CRUSHED CHARCOAL	3 SACKS
RICE BRAN	2 SACK (100 KG)
COFFEE HULS	20 BAGS

BOCASH FOR COFFEE FARMERS FORMULA NO.6

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
PIG/COW DUNG	20 SACKS
COFFEE PULP	20 BAGS
YEAST	1 KG
CRUSHED CHARCOAL	3 SACKS
RICE BRAN	1SACK (50 KG)

BOCASH FOR BANANA FARMERS FORMULA NO.1

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
POULTRY MANURE	20 SACKS
YEAST	1 KG
CRUSHED CHARCOAL	3 SACKS
RICE BRAN	1 SACK (50 KG)
SHREDDED BANANA STALK	20 BAGS

BOCASH FOR BANANA FARMERS FORMULA NO.2

INGREDIENTS	QUANTITIES
SOIL	20 SACKS
POULTRY MANURE	20 SACKS
YEAST	2 KG
CRUSHED CHARCOAL	3 SACKS
RICE BRAN	1 SACK (50 KG)
SHREDDED BANANA STALK	20 BAGS

- MIX WATER WITH COOFFEE MUCILAGE SINCE IT CONTAINS MANY ENZYMES

HOW TO MIX BOCASH

- BEFORE PREPARATION;
- ALL NECESSARY INGREDIENTS MUST BE OBTAINED AND BEST PREMISES CHOSEN
- ONE MUST MAKE USE OF AVAILABLE ON SITE OR NEARBY

MIXING INGREDIENTS--LIQUIDS

MIX WATER,YEAT AND MOLLASES TO GETHER IN A BUCKET

STIR THESE MIXTURES THOROUGHLY

WHILE MAKING BOCASH,TAKE LITLE OF THESE MIXTURE WITH FRESH WATER

USE THESE MIXTURE TO SPRINKLE ON BOCASH WHILE MIXING UNTILL YOU GET THE RIGHT FIST TEST.

MIXING SOLIDS-EXAMPLE 1

MIX INGREDIENTS BY ALTERNATE BEDS

UNTILL OBTAINING HOMOGENOUS MIX

THEN THE INGREDIENTS ARE MIXED THOROUGHLY AS YOU WATER

MIXING SOLIDS-EXAMPLE 2

MIX ALL INGREDIENTS DRY,AND AT THE END,THE LAST TIME , TURNOVER THE MIXED PILE,ADD WATER UNTILL REACHING APPROPRIATE HUMIDITY

MIXING SOLIDS-EXAMPLE 3

SUB DEVIDE ALL INGREDIENTS IN EQUAL PROPORTIONS,

FORM TWO OR THREE PILES

MIX ALL INGREDIENTS OF EACH ONE OF PILE

ADD THE APPROPRIATE AMOUNT OF WATER TO CONTROL HUMIDITY

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