The Benefits and Nature of Bio-Plant and Pro-Plant, 100% Organic, Liquid Bio-fertilizers

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ปุ๋ยน้ำชีวภาพ (BIOFERTILIZERS)
ไบโอ-แพลนท 99
BIO-PLANT
สูตรดิน
เพิ่มธาตุอาหาร สร้างสารกระตุ้นการเติบโต
ปรับปรุง บำรุงดิน เพิ่มผลผลิตพืช ลดการใช้ปุ๋ย
1 ลิตร
U.S.A. Technology
หัวปุ๋ยน้ำชีวภาพ
โปร-แพลนท 99
PRO-PLANT
สูตรใบ
1 ลิตร
อาหารเสริมพืช เร่งการเจริญเติบโต
บำรุงดินดี เพิ่มผลผลิต
U.S.A. Technology

1. Introduction

A Summary of the Contents

- This presentation:
  - Explains what Bio-Plant and Pro-Plant are made from;
  - Why they are effective and produce higher crop yields than chemical fertilizers;
  - Why they meet the needs of chemical farmers;
  - Provides a few typical results of their use;
  - Compares the costs of using them with organic fertilizers and chemical fertilizers.

The Sections in This Presentation

1. Introduction.
2. Bio-chemical Farming as the Best Strategy for Change.
3. The Composition of the Bio-fertilizers and Their Benefits.
4. The Benefits of Foliar Spraying With Pro-Plant.
5. Benefits for 100% Organic Farming.
6. Some Typical Field Test Results.
7. Effect on Diseases, Pests, and Weeds.
8. Using Bio-Plant and Pro-Plant in Dry Areas.
9. Comparison of Bio-chemical and Chemical Farming.
10. Comparison of the Bio-fertilizers and Urea & NPK
11. What is a Bio-fertilizer?
12. Comparison of Costs by Type of Farming

The Main Differences Between Bio-Plant & Pro-Plant and US$10 Bags of Solid Organic Fertilizer

The Content of Organic Fertilizers

- The main organic fertilizers are made from peat, animal wastes (cow manure, chicken dung, cow urine, products of the slaughter of animals, etc.), plant wastes, meals, and other nutrient-rich materials. These are mixed with soil.
- Most solid organic fertilizers serve to provide nutrients to the soil - mostly NPK with a few minor minerals, but few, if any, trace elements.
- Most do not infuse the soil with much microbial life.
- Many assume that the soil already has good microbial life, and they just provide nutrients and aerate the soil.

The Quantity Used Per Hectare

- The farmers will need to use 20 or more x 50 kgs bags per hectare. Some Indian brands recommend at least 50 bags per hectare. This makes the cost very high.
- In contrast, farmers:
  - Prepare one hectare (or 2 hectares) with 1 litre of Bio-Plant mixed with 5 MT of organic matter;
  - Spray 2.5 - 3 litres of Pro-Plant on the leaves during a 3-month crop.
- In bio-chemical farming, chemical farmers halve the amount of Urea/NPK they use by mixing each bag with 330 cc of Bio-Plant.

Solid Organic Fertilizers Do Not Meet the Needs of Chemical Farmers

- Chemical farmers generally want to lower their costs and need a solution to the harmful effects of the chemicals.
- They usually will not change to 100% organic farming because it requires a change of habits and because they are afraid that organic fertilizers will reduce their yield.
- They will change to bio-chemical farming because they do not have to give up their granular chemical fertilizers.
- Solid organic fertilizers are not suitable for or effective in bio-chemical farming.
- Consequently it is hard to make chemical farmers buy solid organic fertilizers, even if they are cheap.

A Summary of the Benefits of Bio-Plant and Pro-Plant

- In contrast:
  - Bio-Plant infuses the soil with the micro-organisms which have been killed off by chemical agriculture; restores the Nitrogen Cycle and the soil's fertility; makes unused chemical NPK deposits and unabsorbable nutrients available to the plant; fixes extra Nitrogen from the air; and restores the plant's immune system so that chemical sprays are not needed.
  - Pro-Plant provides 55-60 nutrients through the leaves so that they are available immediately to the plant; protects the plant from disease.
- Solid organic fertilizers do not do this.

2. Bio-chemical Farming as the Best Strategy for Change

Impending Global Food Shortage

Common Problems Faced By Farmers

- Rising cost of agricultural inputs.
- Because of the high cost of chemical inputs, farmers often use less, so their yield is low.
- Higher costs in obtaining the same yield as before.
  - Chemical agriculture has weakened the soil's fertility, so more Urea and NPK are needed.
- Weak and infertile soil – the result of 1-2 generations of chemical agriculture.
- Crop diseases resulting from continuous chemical agriculture, which weakens the immune system over time.

Major Problems Faced By Farmers

- Weak and infertile soil. This threatens food security.
  - The poor can only get poorer. The soil needs a massive infusion of microbial life (Bio-Plant).
- Farmers cannot afford chemical fertilizers, and the people don't know about the benefits of bio-technology.
- Overuse of chemicals in agriculture.
  - Yields will increase with bio-chemical farming.
- Crop diseases
  - How Bio-Plant and Pro-Plant reduce disease and pests significantly is explained below.
- Lack of grassy grazing land for cattle.
  - This can be rectified with the use of Bio-Plant.

Major Problems Resulting from Chemical Agriculture

- Health and nutrition problems caused by the chemicals in the soil and food.
- Pesticides polluting water.
  - Caused by chemical agriculture.
- A shortage of trees.
  - The bio-fertilizers increase the growth rate of trees.
- Waste water pollution.
  - Bio-Plant can be used to treat waste water and rubbish.
  - Sugar mill waste water can be treated effectively with Bio-Plant.
  - The rubbish can be treated with Bio-Plant and used for soil fertilization.

Bio-chemical Farming as the Main Strategy for Change

- Governments in Africa know that they have to phase out chemical agriculture and change to 100% organic farming.
- But farmers resist the change to organic farming.
  - Why? Because they have farmed with granular chemicals for maybe a whole generation. It is a way of life for them.
  - Bio-chemical farming solves the problem because the farmers hardly have to change their habits. They can still use granular fertilizer.

Bio-chemical Farming as the Main Strategy for Change

- The main strategy to bring about change and to get chemical farmers off chemical farming in a way, which they can accept, is **bio-chemical farming**.
  - We find that in Thailand and Vietnam few farmers will change directly to 100% organic farming as it requires too much sudden change to their habits.
- Probably 60% of all rice and maize in Thailand and Vietnam is grown with bio-chemical farming, with the percentage increasing all the time because the yields are higher and the costs drop by about 45%.
  - The chemical fertilizer producers in Thailand are feeling the winds of change.

Using the Bio-fertilizers for Bio-chemical Farming

- When farmers mix 330 cc of Bio-Plant with each 50 kgs bag of chemical fertilizer in bio-chemical farming they can halve the amount of chemical fertilizer they use.
  - Each 50 bag can be used over twice the area.
  - Usually, their costs drop by about 45%.
- If they also spray Pro-Plant on the leaves (500 cc per hectare) the yield will rise 25%+.
- If the farmers soak the seeds in Bio-Plant and Pro-Plant as well, they will add 5% to the yield.

Using the Bio-fertilizers for Bio-chemical Farming

- If the farmers prepare the soil with Bio-Plant mixed with organic matter (1 litre with 5 MT of organic matter – ideally 40+% should be chicken dung and cow dung), the yield will increase further.
- In field tests with just Bio-Plant and no soil preparation with Bio-Plant, the *initial* yield may only be about 10%. But the savings will be about 45%.
  - The main advantage with this method is that farmers almost halve their costs.
  - The yield will increase each season with the input of micro-organisms in Bio-Plant, but the big yield increases of 50%, such as in Thailand with rice and maize, come when the soil is also prepared with Bio-Plant.

The Importance of Soil Preparation in Bio-chemical Farming

- Farmers must understand that they have to restore the soil's microbial life before their soil will become fertile again.
  - Often the soil has suffered from neglect as a result of 20 years of chemical farming, and the microbial life has been killed off.
  - If farmers want the big yield increases in bio-chemical farming, they must also prepare their soil with Bio-Plant and organic matter, and soak the seeds in Bio-Plant.
- Nevertheless, even without extra soil preparation the yield will increase, but more slowly.

The Effect of Soil Preparation With Bio-Plant in Bio-chemical Farming

- Each 1 cc of Bio-Plant contains about 1 billion cells. Each cell multiplies into 1 million cells in a day in the soil. When Bio-Plant is mixed with organic matter, the organic matter becomes like a factory mass-producing micro-organisms.
  - This is why the soil's fertility is restored quickly, and why farmers get higher yields quickly.
  - There are ways to increase the rate of multiplication of the cells further.
- Farmers should prepare the soil and leave it for 2 weeks before planting so that the micro-organisms can multiply.
- Soil that has been prepared very well shows very good increases in the yield in bio-chemical farming.

3. The Composition of the Bio-fertilizers and Their Benefits

Bio-Plant
The Main Ingredients

Bio-Plant contains a wide range of beneficial, micro-organisms and fungi in a very concentrated form. No chemicals are used.

Bio-Plant
The Main Micro-organisms

Microorganisms

Bacillus
Achromobacter
Streptomyces
Enterobacter
Nitrobacter
Nitrosomonas
Chlostridium
Pseudomonas

Fungi

Aspergillus
Polyporus
Rhizopus

The micro-organisms in Bio-Plant can withstand and function in very acidic soil (pH 4).

1 cc contains is composed of 10^{xx} micro-organisms.
Each cell multiplies at the rate of 1 cell into about 1,000,000 cells in a day in the soil.

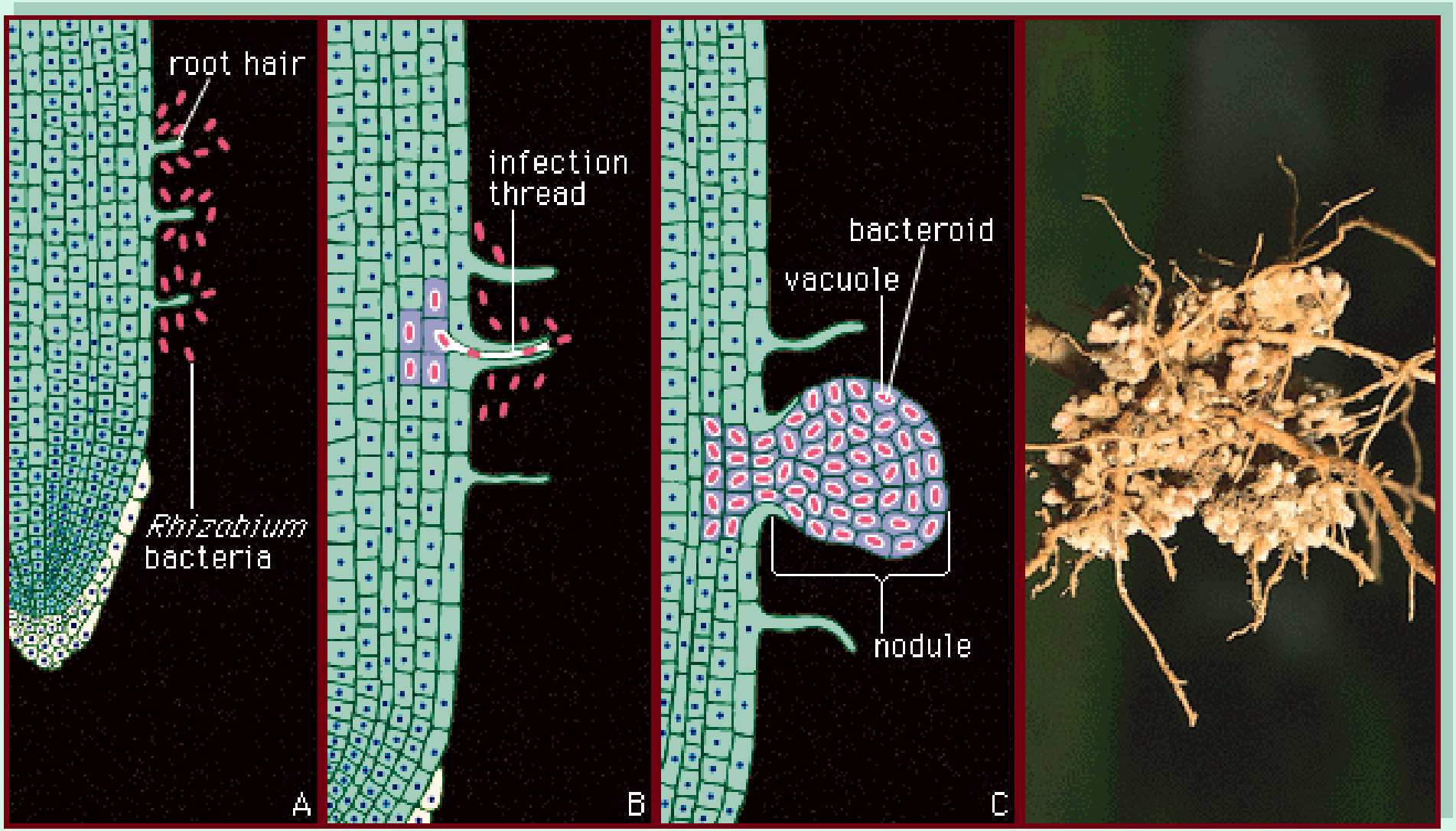
Bio-Plant
General Benefits (1)

- The micro-organisms improve the physiology and biology of the soil by “flooding” it with micro-organisms.
- Certain micro-organisms fix extra Nitrogen from the air for the plants.
- They also decompose organic matter and extract nutrients for the plants, and which cannot be accessed.

Bio-Plant
General Benefits (2)

The microbial fertilizer bacteria colonize crop roots and start to multiply. The bacteria bind with the root hairs and cause root cells to swell, forming nodules. Within these nodules, the bacteria work as miniature “nitrogen factories,” pulling nitrogen from the air and converting it into a form the plant can use.

Effect on the Roots



Bio-Plant
General Benefits (3)

- They dissolve the large amounts of N, P, and K left unusable in the soil by chemical fertilizers, and enable plants to absorb them, thereby cleaning the soil of chemicals.
- **Weak**, **hard**, and **acidic** chemical soil can be restored in 3 years if a lot of organic matter mixed with Bio-Plant is used.

Bio-Plant
General Benefits (4)

- Applying Bio-Plant to the soil increases the micro-organisms in the soil greatly. The soil becomes aerated, loose and fertilized, and the plants can absorb minerals consistently.
- Because chemical agriculture kills the micro-organisms in the soil, the soil becomes hard and weak, causing farmers to have to use more and more chemical fertilizers to get previous yields, and this increases their costs.

Bio-Plant
General Benefits (5)

- Bio-Plant immunizes against pathogens so that the crops are much less prone to pests and disease.
- Bio-Plant's micro-organisms break the life cycle of soil-based pests.
- The stems of crops tend to be thicker, and harder for pests to eat.

Bio-Plant
General Benefits (6)

- By mixing 100 cc of Bio-Plant with 1 kg of large seeds, or by soaking small seeds in Bio-Plant and Pro-Plant, the crop yield can be increased by 5% - 10%.
- When you mix 100 cc of Bio-Plant in 20 litres of water and spray it on weeds, the concentration of micro-organisms can be used as an organic herbicide.

Benefits of Bio-Compost

- It kick-starts the soil and starts a major process of refertilizing the soil. The farmers should make 5 tonnes of bio-compost per hectare by spraying the compost waste matter with 1 litre of Bio-Plant and leaving it for 6-7 weeks.
- Chemical fertilizers cannot make this quality of compost for the cost of 1 litre of Bio-Plant.
- The farmers can expect to increase their yield as they use bio-compost.

Bio-Plant

Benefits of the Micro-organisms

- 1 cc of microbial liquid fertilizer is composed of 10^{xx} micro-organisms, which can be identified into 4 groups of micro-organisms:

1. Micro-organisms which produce Nitrogen
2. Micro-organisms which produce Phosphorus
3. Micro-organisms which produce Potassium
4. Micro-organisms which turn minor elements into a useable and absorbable form.

1. Micro-organisms Which Produce Nitrogen

- Micro-organisms break down the contents of chemical fertilizers into Nitrogen for the plants.
- Rhizopus fungi fix Nitrogen from the air.
- Certain micro-organisms in Bio-Plant have an enzyme which transforms Nitrogen gas into amino acid and other forms of Nitrogen that are useful for plants.

2. Micro-organisms Which Produce Phosphorus

There is, of course, Phosphorus within the soil, but it is not easily absorbed in soil with a pH that is too high or too low.

The micro-organisms in Bio-Plant raise or lower the pH to a suitable, natural level so that it is more easily available.

2. Micro-organisms Which Produce Phosphorus (cont.)

Bio-Plant consists of some micro-organisms that dissolve Phosphorus easily so that the roots can absorb it

3. Micro-organisms Which Produce Potassium

- Potassium plays a major role in protein, carbohydrate, and fat synthesis, so the quality and quantity of the crop yield depend on Potassium.
- The most rapid and appropriate way to obtain Potassium is through bio- and organic weathering by micro-organisms, which tolerate the soil’s pH.

4. Micro-organisms Which Make Available Other Minerals

Each kind of plant needs different minor elements. These elements exist naturally, but often in an unusable form.

They need certain micro-organisms to transform them into a usable form.

Bio-Plant has micro-organisms which transform them as required.

Pro-Plant
What It Is

- It is produced from fish enzymes by a micro-biological complexation process that the company has created.
- It provides through the leaves the proteins, and minerals that plants need to grow quickly, healthily, and abundantly.
- Coating the leaves with Pro-Plant also protects the plants from disease significantly.

Pro-Plant
Composition

This bio-liquid fertilizer is composed of major nutrients (Nitrogen, Phosphorus, and Potassium), and a wide range of essential minor nutrients that a plant needs for healthy and strong growth.

Pro-Plant
Main Benefits

- It stimulates the respiratory and photosynthesis systems so that the plant can absorb more nutrients.
- It is usable instantly by the leaves or roots.
- It accelerates plant growth, blooming, and fruit forming.
- It improves the soil structure.
- It increases the absorption rate of nutrients.
- It supplements the Carbon Dioxide-fixing process.
- The plant is healthier, resulting in tolerance to pests.
- It increases the quality and quantity of the crop yield, resulting in increased income for farmers.

Pro-Plant Improves the DNA

The production process for Pro-Plant uses fish enzymes to dissolve the fish into amino acids, which then produce nucleatoids, which improve the DNA of plants. In turn, the quality and yield of the crops improve each year. The DNA is improved naturally.

No Need for GM Technology

The DNA can, therefore, be improved naturally without the need for Monsanto's GMO technology, and 100% organic crop yields and quality can be increased naturally.

DNA of Seeds Can be Improved

Artemis & Angel Co. Ltd. can also improve the DNA of local seeds for different purposes, such as to increase tolerance to drought, to increase the yield, to improve the flavour, etc., by combining the DNA of different local seeds according to their strengths.

Again, this should not be confused with what Monsanto does.

4. The Benefits of Foliar Spraying With Pro-Plant

Efficiency of Foliar Spraying

- Foliar feeding increases the nutrients available to each plant, like a regular dose of vitamins and supplements.
- Within one hour, according to the scientists, a plant can transport minerals from its leaves all the way down to its roots. Compared to root feeding, this is like the fast track.
- Stomata transport nutrients up to ten times more efficiently than root systems.

Ensures Abundant Nutrients

- Because Pro-Plant contains a very wide range of minor minerals and trace minerals, mineral deficiencies can be taken care of easily.
  - The microbe-rich droplets drip off the leaves to improve soil and growing solutions.
- Each species of plant has both general and specific mineral needs. When these minerals are missing from the soil, a range of confusing symptoms appear.
  - We may not discover the specific reason quickly enough to prevent plant collapse. Even when we do, that plant will take time to recover and may never reach optimum productivity.

Benefits of a Fish Foliar Spray

- Most vegetation requires a minimum of 16, but probably more like 50 essential minerals and trace elements.
- Fish is high in organic nitrogen and is a wonderful source of minerals, particularly potassium, and has a wide range of trace elements and hormones beneficial for cellular development.
- When sprayed in a very diluted form (1 litre mixed with 1,000 litres of water, which is enough for 2 hectares), sea minerals provide most elements needed to prevent deficiencies.

General Effects

- When you spray with Pro-Plant, you envelope the plant with living organisms (microbes) and you enhance the web of life of which the plant is a part. The plants receive both micro-organisms and nutrients.
- The results can be astounding: large, mineral rich vegetation with clear glossy leaves, decreased disease, and greatly lessened insect attacks.

General Benefits

- Plants treated with Pro-Plant's foliar fertilization have higher "Brix" levels.
  - Brix is a measure of the carbohydrates and mineral density in the sap.
  - High Brix is said to make the plants less attractive to pests and more resilient to stress.
- Vegetables, grains, and fruit taste better.

100% Organic Farming Rice Field Test in Taraba State – Pro-Plant Used Only

In this field test on rice, the farmers did not prepare the soil with Bio-Plant and organic matter, and only sprayed Pro-Plant on the rice. Nevertheless, the farmers said that the crop yield was more that you ever got with Urea and NPK. In addition, their costs were very much lower because they only needed one litre of Pro-Plant per hectare.

5. Benefits for 100% Organic Farming

Benefits for Yield and Savings

- When farmers prepare the seeds and soil with Bio-Plant, and spray Pro-Plant mixed with water on the leaves, the crop yield increases by anything from 15%-100%, but 30% is most common in the first season above what chemicals achieve.
  - The yield increases are high when the farmers take soil preparation with Bio-Plant seriously as Bio-Plant restores the soil's microbial life.
  - The yield increases in each season as the soil becomes more fertile and the bio-fertilizers clean the soil of the unabsorbed chemical NPK deposits left by chemical fertilizers.

Effects of the Bio-fertilizers in 100% Organic Farming

- The costs are much lower.
- Sometimes we meet farmers in Thailand who tell us that they are making a good profit for the first time as their costs have dropped 60% - 75% since they stopped using chemical fertilizers and changed to organic farming with the bio-fertilizers.

100% Organic Farming
Normal Application

- Mix Pro-Plant (20 cc) with 20 litres of water and spray the crop every 2 weeks on average (every 7 days with small vegetables). 500 cc per hectare.
- The farmers should prepare the soil with bio-compost (5 tonnes per hectare, using 1 litre of Bio-Plant); *or* spray the soil with Bio-Plant (500 cc) mixed with water (500 litres), and Pro-Plant (500 cc) if the soil is poor, and leave the soil for 14 days before planting the crop.

Savings in 100% Organic Farming (Part 1)

- 2.5 - 3 litres of Pro-Plant and 1-2 litres of Bio-Plant per hectare is the normal amount for a 3-month crop.
- There is no need to use toxic insecticides, herbicides, and fungicides, so farmers save money there too.

Savings in 100% Organic Farming (Part 2)

- 50 kgs. = US$38 per bag *(average price).*
- 3 bags (50 kgs) of Urea and 3 bags of NPK per hectare is common.
- Cost: US$38 x 6 bags = US$228 per hectare.
- There are additional costs for insecticides, herbicides and pesticides.
- **Saving:** Commonly around 70%-75%, but it depends on the local price, the number of bags of chemicals used, and the crop. (The farmers can afford to use more Bio-Plant to restore the soil.)

6. Some Typical Field Test Results

Main Countries of Operation
Thailand and Vietnam

- Farmers have used the bio-fertilizers for about 13 years in Thailand and Vietnam where their use is very widespread.
- Because of the level of sales and their popularity with distributors and farmers, there are 4 brands of the same bio-fertilizers in use.

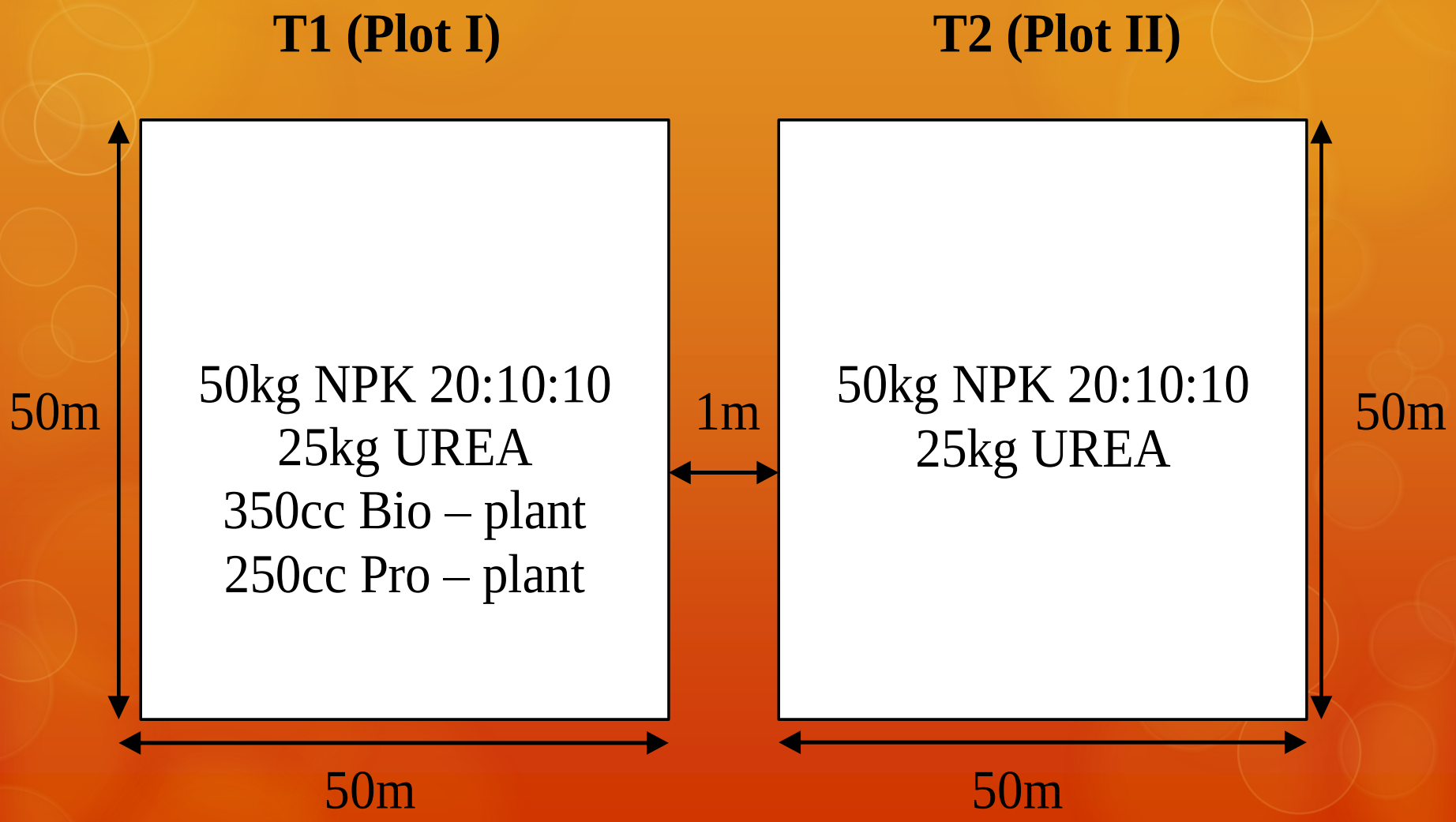
Countries with Field Tests

- Because of the increasing need of developing countries to phase out chemical agriculture in order to achieve food security, and their shortage of finance to achieve this goal, over the last few years we have offered many governments a Credit Fund of US$125 million over 5 years with no change of price.
- As a result of very good field tests several state and national governments have agreed to the proposal for different amounts.

Countries With Field Tests

- Field test results have been carried out in the last few years in Azerbaijan, Bangladesh, China, India, Indonesia, Malaysia, Mauritius, Nepal, Pakistan, and the Philippines.
- In Africa: Benin, Cameroon, Ghana, Guinea, Liberia, Malawi, Namibia, Nigeria, Rwanda, Sierra Leone, Swaziland, and South Africa.

Maize Field Tests Conducted in 2011 in Gombe State, Nigeria



Summary of the Results

- The trials were held at the two different locations. Each test showed distinctive differences between Plot I and Plot 2 in terms of plant height, stem size and corn ear size.
- Apart from these, Plot 1 in which the organic liquid was applied mixed with conventional fertilizer, had cobs (com ear) maturity/drying with the stem and leaves still green, while Plot 2 had shorter plants, smaller cobs with the plant and cob drying at the same time.


Chemical Maize
Bio-chemical Maize with Bio-Plant, and Pro-Plant sprayed on the leaves.


A Mature Cob in Plot I With the Stem and
Leaves Still Green

Field Test Yield Results

Location	Treatment	Yield/Plot (Kg)	Yield/Hectare (Kg)
Pokata	T1	750	3,000
	T2	325	1,300
Posulte	T1	500	2,000
	T2	350	1,400

Group Photograph of the Farmers After Observing the Very Good Results

Comments

- The farmers were very happy with the results.
- These very good results were achieved in bio-chemical farming without any soil preparation as the tests started late in the maize season. In spite of this, the impact was so apparent.
- Pro-Plant also had an insecticidal effect on weevils, grasshoppers, and even aphids, which impressed the farmers in the area.

Effect on Maize in Malawi

2010-2011 Report

Evaluation of Bio-Plant and Pro-Plant Fertilizers for Soil Fertility Improvement and Maize Grain Yield Production. Soil Fertility and Plant Nutrition Section and Plant Pathology Section, Bvumbwe Agricultural Research Station, Malawi

Effect on Maize in Malawi
Summary

- Field tests on maize in soil with a high level of Mn and Fe showed much better growth in terms of yield, colour, and healthiness than what chemical fertilizers achieved. The bio-fertilizer maize was free of any signs of soil toxicity or disease.
- In a 100% organic farming field test the increase in the yield of maize was about 30% while the costs were reported as being "significantly less".
- The results of the second round of field tests on maize, which finished in July 2011 were excellent.
- **Nb:** The 3rd year of tests finished with excellent results in March 2012.

Effect on Maize in Malawi
Soil Test Results

- The results indicated that there were significant differences (P≥o.5) between bio-organic and bio-chemical farming.
- The mean of pH, OM, and N were higher in bio-organic than in bio-chemical farming, while for P it was higher in bio-chemical than in bio-organic treatments. The values were higher in treatments treated with Bio-Plant and Pro-Plant than the control.
- The results suggest that Bio-Plant and Pro-Plant enhanced availability of nutrients to the maize plant.

Effect on Maize in Malawi
Maize Grain Yield Results

- Results on the effect of bio-organic and bio-chemical farming on maize yields indicated that there were significant (P=0.05) yield differences among the treatments and between the farming types.
- The grain yields were higher in all the treatments using Bio-Plant and Pro-Plant compared to the chemical control at both sites at Bembeke and Bvumbwe

Effect on Maize in Malawi
Maize Grain Yield Results

- The combined use of chemical fertilizer and 330 cc of Bio-Plant microbes gave the highest maize grain yields of 5,514 kg/ha at Bvumbwe and 4,883 kg/ha at Bembeke.

Effect on Maize in Malawi
Maize Grain Yield Results

- The use of 300 cc Bio-Plant plus 300 cc Pro-Plant in 420 litres of water mixed with 3000 kg. organic material per hectare in bio-organic farming and the use of 990 cc Bio Plant + 150 kg (100 kg 23:21:0+4S; 50 kg Urea) fertilizer gave the optimum maize grain yield production at Bembeke.
- The use of 660 cc Bio-Plant plus 100 kg (67 kg 23:21:0+4S; 33 kg Urea) fertilizer in bio-chemical farming and the use of 300 cc Bio-Plant plus 300 cc Pro-Plant in 420 litres of water mixed with 3,000 kg organic material per hectare in bio-organic farming gave the optimum maize grain yield production at Bvumbwe.

Effect on Maize in Malawi
Maize Grain Yield Results

- The bio-fertilizers further enhanced the availability of soil macro (such as P and K) and micro (such as Mg, Zn, etc.) nutrients, their uptake, and efficiency of use by the maize plants as compared to the treatment where 300 kg/ha of chemical fertilizer alone were applied.

Effect on Maize in Malawi
Conclusion

- The significant differences in grain yield were due to the effects of the Bio-Plant and Pro-Plant in the treatments.
- Bio-Plant and Pro-Plant microbes mineralized and fixed more soil and atmospheric N respectively and made them available to the crops for uptake.

Effect on Maize in Malawi
Conclusion

- Bio-Plant and Pro-Plant bio-fertilizers significantly improved soil fertility, and made available more soil nutrients, such as N, P, K etc.
- Bio-Plant and Pro-Plant bio-fertilizers significantly increased maize grain yields and were more effective than chemical fertilizers.

Examples of Efficacy in Field Use

Cameroon

- ***Tomatoes:*** Bio-chemical farming tests on tomatoes (2012) reduced the farmers' costs by around 70%.
- There was no disease in the crop unlike in the farmers' chemical tomato crops.
- The tomatoes were larger.
- There were more tomatoes than when the farmers farmed chemically.

Examples of Efficacy in Field Use

China

- ***Tobacco:*** Field tests on tobacco in Yunnan province, China, showed a 35% increase in yield in 100% organic farming compared to chemical fertilizers, with much lower costs. The leaves were larger, longer, and fresher-looking. The soil was prepared well.
- ***Rice:*** Field tests on rice in Harbin, north China, showed a 50% increase in yield in 100% organic farming compared to chemical fertilizers, along with much lower costs. The soil was prepared well.

Examples of Efficacy in Field Use

Indonesia

- ***Rice:*** The results of government field tests on rice in Indonesia came out as "excellent" (around 35% higher) in 100% organic farming compared to chemical fertilizers.
- The quality of the rice was superior to rice grown with Urea & NPK and all of the other organic fertilizers tested, and the production cost was significantly lower compared to chemical fertilizer.
- The import license was issued as a result of these tests.

Examples of Efficacy in Field Use

Mauritius

- ***Green Beans:*** Field tests on ***green beans*** in Mauritius showed a 30% increase in yield in 100% organic farming compared to chemical fertilizers, with much lower costs.

Nepal

- ***Rice:*** In 100% organic farming field tests with rice showed an increase in yield of about 30%. The soil was prepared with Bio-Plant and organic matter.

Examples of Efficacy in Field Use

Myanmar

- ***Various Crops:*** Many field tests have been carried out with very good results.
- ***Cabbages 1:*** In one 100% organic farming test carried out with cabbages in soil that had a toxic level of Manganese, the Control crop grew poorly and had a lot of brown leaves while the bio-fertilizer crop was very green and the growth was far superior.
- ***Cabbages 2:*** In another 100% farming test on cabbages in the West Bago region 200 cabbages weighed the same as 400 cabbages grown with chemicals. The details are below.

Cabbage Test Area (8 acres) Using Bio-Plant and Pro-Plant in 100% Organic Farming

1. Soil preparation: 25 kgs local organic fertilizer + 125 cc of Bio-Plant mixed and applied to each acre.
2. Then 62.5 cc of Pro-Plant was sprayed on the leaves mixed with 62.5 gallons of water per acre.
3. Total cost of using the bio-fertilizers:
   a. Organic fertilizer + Bio-Plant: 9,000 Kyats = US$9 / acre x 8 acres.
   b. For 8 acres: 72,000 Kyats = US$72 / 8 acres.
   c. Pro-Plant sprayed: 32,000 Kyats = US$32 / 8 acres.
   d. Total cost (8 acres): 72,000 + 32,000 = 104,000 Kyats = US$104.
   e. One cabbage weighed 4.8 kilos.
   f. There was no need to use pesticides.

Control Area (8 acres) Using Chemical Fertilizer

a. Charcoal: 10,000 Kyats / acre = US$10
b. Cow dung: 20,000 Kyats / acre = US$20
c. Carbofuran pesticide on soil: 15,000 Kyats / acre = US$15
d. Chemical fertilizer (10 bags): 60,000 Kyats acre = US$60
e. Urea 46% (2 bags): 40,000 Kyats / acre = US$40
f. Pesticide sprayed: 30,000 Kyats / acre = US$30
g. Total cost for acre: 175,000 Kyats / acre = US$175
h. Total cost for 8 acres: 1,400,000 Kyats / 8 acres = US$1,400
i. One cabbage weighed 2.4 kilos.

Bio-chemical Farming Maize Field Test in Karfe Town, Suleja, Niger State, Nigeria

- The maize seeds were soaked in Bio-Plant and water for 12 hours before planting.
- The soil, which was in poor condition owing to years of chemical farming, was prepared with a bio-chemical mixture of Urea and Bio-Plant.
- Bio-Plant was mixed with NPK and this bio-chemical mixture was sprinkled around the maize plants during the crop. Pro-Plant was sprayed regularly on the maize.
- Normally, the farmers has problems with insects during their maize crops, but this time there were no problems with insect pests at all. No chemical sprays were used.
- The farmers almost doubled their yield. Normally, they only produced 30-40 bags of maize per hectare, but this test produced 60 bags per hectare.

Bio-chemical Farming Maize Field Test in Karfe Town, Suleja, Niger State, Nigeria

Bio-chemical Farming Rice Dry Season Field Test in Jamaare, Bauchi State, Nigeria

- The rice seeds were soaked in Bio-Plant and water for 18 hours before planting.
- The soil was in poor condition. It was prepared with a bio-chemical mixture of Urea and Bio-Plant.
- Bio-Plant was mixed with NPK.
- Pro-Plant was sprayed regularly on the rice plants during the crop.
- No chemical sprays used.
- The farmers normally only produced 50 bags of rice per hectare, but this test produced 80 bags per hectare, which is a 60% increase.

Examples of Efficacy in Field Use

Philippines

- ***Rice:*** 100% organic farming field tests on rice showed a 30% and 85% increase in yield. In the second of the tests the farmers prepared the soil more effectively.

Rwanda

- ***Flowers:*** Tests on roses resulted in fresher-looking stronger-smelling roses. The rose bushes grew more densely, and some of the stems appeared much thicker than the rest of the stems in the control area. The height of the plants had increased as well.

Examples of Efficacy in Field Use

Vietnam

- ***Sugarcane***
- The farmers increased their yield significantly compared to when they used chemical fertilizers.
- Many sugar factories only want to buy from farmers who grow their sugarcane crops with Bio-Plant and Pro-Plant, principally because the sugar from the sugarcane is sweeter than chemical sugarcane - usually about 20% sweeter on analysis.

Examples of Efficacy in Field Use

Vietnam

- ***Sugarcane***
- The yield of sugarcane crops grown in wet rice fields increased by 40% - 50%.
- On normal land farmers increased their usual yield of 50 tonnes per hectare to 70 tonnes.
- When flooded with water the sugarcane yield increased up to 100 tonnes.
- Where farmers use an irrigation system the yield increased up to 120 tonnes.
- They reduced their costs by 30% - 35% compared to chemical fertilizers.

Examples of Efficacy in Field Use

Vietnam

- ***Sugarcane***
- Some sugarcane factories mix Bio-Plant with the filter cake waste of sugarcane, and the farmers increase their productivity 5% - 10% by using it to prepare the soil instead of urea.
  - Consider the benefits for the country, if the sugar mills were to use all of their waste for cheap soil refertilization.
- Farmers who mix Bio-Plant with chemical fertilizer halve the amount of chemical fertilizer they use.

Bio-organic Fertilizer Produced From the Waste of Bio-fertilizer Sugarcane

Examples of Efficacy in Field Use

Vietnam

- ***Sugarcane***
- There was a significant effect on the growth parameter:
  - number of internodes per cane
  - internodal length
  - tops weight
  - trash weight
  - sucrose contents
  - yield components (number of millable canes, cane length, cane diameter, weight per stripped cane and stripped cane yield).

Examples of Efficacy in Field Use

Vietnam

- ***Sugarcane***
- There was a significant effect on the yield components:
  - number of millable canes
  - cane length
  - cane diameter
  - weight per stripped cane
  - stripped cane yield

They Regenerate the Soil
Observed in Many Countries

- Because of the many different types of micro-organisms in Bio-Plant, and the nutrients in Pro-Plant the bio-fertilizers regenerate the soil, even sandy soil.
  - The micro-organisms enable plants to absorb the chemicals left by chemical fertilizers.
- The soil regeneration has been very noticeable over 2 years of field tests in Benin where the soil tends to be very hard and weak owing to over-use of chemicals. Many farmers have testified to the soil fertility-regenerating effect.
  - The soil became darker, richer, and the hardness of chemical soil became crumbly.

Effect on the Growth Rate of Trees

- The bio-fertilizers accelerate the growth of trees.
  - Rubber tree saplings in Thailand and Vietnam grow about 20% faster, and they can therefore be transplanted a month sooner.
  - Young fruit trees also grow faster than trees grown with chemical fertilizer when both Bio-Plant is used in the soil preparation and Pro-Plant is sprayed on the leaves.

Effect on the Growth Rate of Trees

- The trees have more roots, the roots are longer, there are more shoots, more leaves, and the leaves have a larger surface area.
  - This is because of the greater amount of nutrients provided by the micro-organisms provided by Bio-Plant, the Nitrogen-fixing micro-organisms, and the nutrients provided when the leaves are sprayed.
- Leaf analysis shows greater amounts of manganese, zinc, phosphate, iron, and chlorophyll.

Effect on the Flowering of Trees

- Fruit trees have more inflorescences and more flowers per inflorescence.
  - An inflorescence is the complete flower head of a plant including stems, stalks, bracts, and flowers.
  - The improvement in flowering measures results from the stimulation effect of the extra and abundant nutrients on the photosynthesis process. This reflects positively in the increased vegetative growth and flowering characteristics.

Effect on the Flowering of Tomatoes and Orange Trees

- Tomato plants have more flowers and therefore more fruit. *(e.g. Tests in Cameroon 2012.)*
- Fewer flowers fall off, so more flowers turn into tomatoes.
- The bio-fertilizers also increase the number of flowers on fruit trees.
  - Orange trees in North Thailand produce more oranges as a result. *(e.g. See the videos showing interviews with Thai farmers at www.artemisthai.com. Also the following photograph.)*

Effect on Seeds

- Rice farmers in Thailand and Vietnam commonly soak their seeds in Bio-Plant and Pro-Plant (20 cc of each in 20 litres of water) for 24 hours before planting in order to increase their crop yield by about 5%.
- Maize farmers often soak the seeds and dip them in a mixture of the bio-fertilizers before planting.
  - The seeds absorb the micro-organisms and nutrients. The micro-organisms strengthen the immune system and the plants are not affected by disease.
- The seeds are fuller and are sold as mother seeds for a higher price in Thailand and Vietnam.

Effects on Rice

- Unlike chemical rice, which is tall and has many green leaves, rice grown with the bio-fertilizers is yellowish-green, shorter, and has fewer leaves.
- The stems are stronger, so the rice plants do not lean over like chemical rice.
- If you pull up a rice plant, you will see about 20% more roots than on a chemical rice plant.
- The roots are stronger and longer.
- The rice heads contain much more grain.
- The rice seeds do not tend to fall off during harvesting.
- The soil is softer and more fertile, and has a lot of worms and insect life.
- *See the following photographs of rice grown in Thailand with the bio-fertilizers.*


Effect on 100% Organic Rice Grown
With the Bio-fertilizers in Thailand


แฟลงสาริด

Effect on 100% Organic Rice Grown With the Bio-fertilizers in Myanmar

Effect on Rice

- There is no problem with the usual rice diseases, such as white spot and rust, because the micro-organisms develop in the rice plants a strong immune system.
- The quality of the rice is such that the seed becomes in demand as mother seeds.
- The taste of the rice is sweeter and has a more flavoursome smell when you cook it.
- Agents in Vietnam comment each season that there are more villages wanting to change from chemicals to Bio-Plant and Pro-Plant in the following season. This is reflected in the sales.

Effect on Millet

- Government field tests on **millet** in Namibia showed "very good growth" and a yield increase of around 30% in 100% organic farming compared to chemical fertilizers. These results occurred even with inadequate soil preparation.
- The tests were conducted over a wide geography of the country and with different patterns of rainfall.
- In all cases, Pro-Plant and Bio-Plant either proved as efficacious as chemicals alone or superior to chemicals. But of course, over time, chemicals impoverish the soil whereas the bio-fertilizers enrich the soil.

Effect on Fruit

- Fruit trees produce more fruit, the fruit is larger, crispier, tastier, sweeter, and the Vitamin C level is higher by about 20%.
- Mangoes grow large and become very sweet. The taste of chemical mangoes pales in comparison.

Effect on Tea Bushes

- There are qualitative and quantitive benefits when the bio-fertilizers are used on tea plantations. The following benefits are common in tea plantations in Thailand and Vietnam:
  - The yield is 20%-30% higher.
  - The leaves look fresher and shine more.
  - The tea bushes have more leaves and branches.
  - The quality and fertility of the soil is superior.
  - The quality of the tea is higher.
  - The tea has a more pleasant scent.
  - The tea has less tannin.
  - The Vitamin C level is higher.
  - Fungicides and insecticides are no longer needed.

Organic Tea Test at Mata Tea Estate, Rwanda

Effect on Tea Bushes

- OCIRTHE, the main tea association in Rwanda carried out tea plantation tests in 2010 with very positive physical and quantitative results.
- The tea leaf colour in the test areas changed from a dark green shade to a lighter green with a distinct shine visible. The leaves were softer and looked fresher.
- This change highlighted improvement in the health of the tea plants and a reduction in the tannin content.
- A noticeable increase in the size of the tea leaves as well as evidence of more leaves per tea bush. This change co-relates to the effective increase in yield.

Bio-fertilizer Tea Growing in North Thailand

Effect on Chillis

- Chillis are longer and heavier than chemical chillis, usually by 20% - 30% while the production costs are much lower both in bio-chemical farming and 100% organic farming.
- Like with all crops produced with the bio-fertilizers, the chillis keep fresh much longer – usually 1-2 weeks.

Effect on Mushrooms

- Bio-Plant is not used in growing mushrooms.
- Pro-Plant is sprayed into the plastic bags which the mushrooms grow in. The yield is 20%-30% higher than chemical mushrooms. The Pro-Plant in the bags keeps the mushrooms growing and producing more mushrooms.
- The mushrooms keep fresh much longer – usually about 2 weeks.


เห็ดนางนวล
Pleurotus salmoneostramineus
เห็ดขอนขาว
Lentinus squarrosulus
เห็ดหลินจือ
Ganoderm lucidum
เห็ดเป๋าฮื้อ
Pleurotus cyctidiosus
เห็ดตูกวาง
Lentinus strigosus


11
8


17


Flammulina velutipes
12
19

Effect on Coffee Trees

- There are many farmers in North Thailand growing coffee with the bio-fertilizers in a 100% organic manner.
- The organic coffee has more aroma, a better flavour, more body, and a fresher after-taste.
- The yield of the trees is especially good when the trees are grown from the sapling stage with Bio-Plant and Pro-Plant. Almost all the berries turn dark at the same time.

Bio-fertilizer Organic Coffee Tree Saplings

Bio-fertilizer Organic Coffee Plantation

Effect on Pineapple

- The fruit is much sweeter than pineapple grown with chemical fertilizer. About 35% sweeter.
- The pineapples are heavier.
- The pineapples look fresher and more attractive to eat.
- There are more suckers and slips so that more pineapple plants can be planted and grown.
- There are more roots and the roots are longer.
- The problems with disease disappear.
- The pineapples keep longer after harvest.

Organic Pineapple Grown With Bio-fertilizer in Thailand

Effect on Tobacco

- In organic farming tests on tobacco in South China the yield increased about 30% compared to chemical tobacco.
- The tobacco leaves became larger, longer, and fresher-looking.

100% Organic Farming Cucumber Field Test in Akwai, Ibom State, Nigeria

- The soil, which was in poor condition before the test, was prepared with Bio-Plant mixed with organic matter.
- The seeds were soaked in Bio-Plant and water.
- Pro-Plant was sprayed regularly on the plants. No chemical sprays were used.
- The farmers said that the cucumbers were larger than they grew with chemicals; they tasted better; they looked fresher; and the quality was better.

Benefits for Rubber Trees

- The growth of young trees is usually 20% - 25% faster than normal, and the saplings can be transplanted a month earlier than normal.
- Bio-Plant stops the growth of fungus when brushed onto the trees.
- The trees produce more latex than when chemicals were used in the past.
- The latex is softer and flows easier.


1 2 2007

7. Effect on Diseases, Pests, and Weeds

Effect on Soil and Pests

- Bio-Plant and Pro-Plant immunize crops against pathogens and disease, and make the crops healthy and pest-resistant.
  - For example: The farmers in Gombe, Nigeria (2011) commented that Pro-Plant had an insecticidal effect on weevils, grasshoppers, and even aphids, which impressed the farmers in the area.

A Healthy Plant Can Resist Pests and Diseases

- The susceptibility of a crop plant to pests and diseases depends on its nutritional state. Pests and diseases will not attack a healthy plant.
- The health of a plant is directly associated with its internal balance.
- But chemical agriculture upsets the internal balance of plants, and make them easy prey for disease and pests.

Unhealthy Plants Provide the Food Pests Want

- It is not just any plant which is attacked by pests and diseases, but only those which could serve as food for the insect or pathogen. In other words, the cultivated plant will only be attacked when the food these pests need is available in the sap.
- If a plant has sufficient quantity of the substances which are food for the pests and diseases, it is because it has not been cultivated in an optimal way.
- A healthy, well-fed plant will seldom be attacked by disease and pests, which will die of hunger on a healthy plant.

Pests and Disease Show That the Plants Are Unhealthy

- Insects, nematodes, viruses, and bacteria are the consequences of problems the plant is having, not the cause.
- Pests and diseases indicate the origin of the difficulties that the plants are having, such as lack of nutrients. These nutrients could be present in the soil, but are not being taken up by the plant owing to the soil's lack of microbial life.

Healthy Plants Medicate Themselves

- Most plants feed by releasing root exudates of precise chemical composition to activate their friendly soil fungi and bacteria which will solubilize elements required by the plant at that time.
- The exudate-composition varies throughout the life of the plant, and any stresses imposed upon it result in further compensatory changes - in essence, the plant practises self medication.
- The term 'nature's smorgasbord' was coined to explain this process.

Chemical Agriculture Upsets the Natural Self-Care System of Plants

- 'Nature's smorgasbord' provides a possible explanation for the prevalence of pest and disease attack in crops fertilized by chemical means - applied soluble fertilizer masks the 'smorgasbord' process, eliminating correct nutrition.

The Bio-fertilizers Enable Plants to Defend Themselves From Attack

- Bio-Plant and Pro-Plant bio-fertilizers feed the plant, and protect the plant, acting as a defense mechanism. A plant which is better fed has better resistance.
- If a plant has everything it needs at its disposition, in the right quantities and at the right time, it has all the conditions to defend itself from insect attack, mites, nematodes, fungi or bacteria.
- Also, because bio-fertilizers are a living product, the micro-organisms present in them can also help in the fight against harmful micro-organisms which are attacking the plant.

How to Use the Bio-fertilizers as an Organic Pesticide

- When you spray Pro-Plant the leaves are coated with micro-organisms that protect the plants and trees from fungal diseases.
- When there is disease in the area mix the Pro-Plant with Bio-Plant as follows:
  - For plants under 1 month: Mix 5 cc of Bio-Plant with 20 cc of Pro-Plant in 20 litres of water, and spray.
  - For plants over 1 month: Mix 10 cc of Bio-Plant with 20 cc of Pro-Plant in 20 litres of water, and spray.
- This will protect the plants and trees. It will not kill insects, but it will strengthen the immune system of the plants and trees so that they can resist diseases.

Some Micro-organisms in Bio-Plant Serve to Prevent Disease

- Not only do the micro-organisms improve the health and immune system of the plants, but certain micro-organisms have a specific function of stopping diseases affecting the plants.
- Depending on the species, they act as a bio-fungicide, a soil inoculant to resist several common crop diseases and provide resistance against pathogens, disinfect the soil, produce secondary metabolites that suppress plant disease, suppress pathogens via antibiotic productions, protect the roots against parasitic fungi, enhance anti-virality, inhibit spore production by pathogenic plant fungi, suppress pathogens in the rhizosphere, and protect trees against infection and decay, for example.

Bio-Plant Remove Soil Pests

- During the first season Bio-Plant removes about 20% of harmful insects in the ground because they break their life-cycle.
- After a few harvests those insects have gone.

Effect on Weeds

- Herbicides can be replaced with Bio-Plant. Farmers find that when they prepare the soil with Bio-Plant and organic matter, and plough it into the ground, the amount of weeds is small. Bio-Plant seems to feed on the weeds and dissolve them.
- Farmers can also spray Bio-Plant directly onto weeds to kill them while fertilizing the soil.

Chemical Sprays Are Not Needed

- Farmers should stop using chemical insecticides, herbicides, and pesticides when using the bio-fertilizers as the chemicals will kill the micro-organisms, which are building up the plant's immune system and killing off the weeds and soil pests.

Certain Micro-organisms Degrade and Clean the Soil of Pollutants

- Certain micro-organisms in Bio-Plant degrade pollutants, and help to remove pesticides from the soil.
- They are capable of degrading a variety of halogenated organic compounds, including trichloroethylene, benzene, and vinyl chloride.
- This ability to degrade pollutants helps the process of controlled bio-remediation.

8. Using Bio-Plant and Pro-Plant in Dry Areas

If there is no water supply or irrigation water, you will need to give extra special focus to preparing the seeds and soil with Bio-Plant and Pro-Plant.

If there is no water for diluting or spraying Bio-Plant, mix 1 litre of Bio-Plant with 1 MT of organic matter. Dig the organic matter into the soil and leave it for 14 days before planting the crop.

If there is no water for spraying Pro-Plant, mix a litre of Pro-Plant with the 1 MT of organic matter at the same time that you mix in the Bio-Plant.

If the farmers use chemical fertilizer, mix 330 cc of Bio-Plant with each 50 kgs bag of chemical fertilizer. This is very effective when there is little or no water for spraying. Combine this with the usual seed and soil preparation methods for maximum effect.

9. Comparison of Bio-chemical and Chemical Farming

Cost Comparison Between Bio-chemical Farming vs Chemical Farming

- The farmers will be able to halve the amount of granular fertilizer they use. For example, instead of using 4 bags of NPK 15:15:15 the farmers will be able to use just 2 bags of the bio-chemical mixture to do the work of the 4 bags of the NPK15:15:15. Their costs will go down about 45% and the yield will be higher. They can test this.
- If the chemical fertilizer producer charges US$30 for a 50 kgs bag of Urea and US$35 for a 50 kgs bag of NPK 15:15:15, for example, at present a farmer will be buying 3 bags of urea (US$90) and 3 bags of NPK 15:15:15 (US$105) per hectare. Total US$195.

Cost Comparison Between Bio-chemical Farming vs Chemical Farming

- This is good for the chemical fertilizer producers, but not good for the farmers, who are suffering from using chemical fertilizer.
- If the chemical fertilizer producer sells bio-chemical fertilizer, the farmers will only have to buy 1.5 bags of bio-chemical Urea (about US$55). This is a significant saving.

Cost Comparison Between Bio-chemical Farming vs Chemical Farming

- The farmers change to bio-chemical farming because they can almost halve their costs while getting at least the same yield.
- At the same time, they have almost no problems with disease and insects, so they save money on chemical sprays too.
- Also, the condition of their soil improves, and this increases the quality of the crops.

Cost Comparison Between Bio-chemical Farming vs Chemical Farming

- By spraying the leaves with Pro-Plant (2.5-3 litres per hectare for a 3-month crop), farmers can add 25% upwards to their yield very quickly.
- Each year the soil's fertility will improve with the Bio-Plant and Pro-Plant, and this 25% will increase further.
- In Thailand the increase is usually 45%-50% after 3 years, but those farmers prepare the soil and seeds with Bio-Plant as well.
- The farmers **will change** to bio-chemical farming using at least Bio-Plant.
- If they cannot afford chemicals, then Bio-Plant will restore their soil's fertility and increase the crop yield for a low cost – 1 litre per hectare.

10. Comparison of the Bio-fertilizers and Urea & NPK

How Bio-Plant and Pro-Plant Are Different to Urea or NPK

- Bio-Plant and Pro-Plant are liquid, 100% organic, microbial bio-fertilizers made with advanced bio-technology.
- They enable a country to phase out chemical agriculture by changing farmers from chemical farming to bio-chemical farming and then to 100% organic agriculture.
- When used together, they produce higher crop yields than chemical agriculture; lower production costs; and they remove many of the causes of the problems caused by chemical agriculture.
- They are 100% natural and contain no chemicals, toxins, or pathogens.

The Contrasting Effects

- Bio-Plant contains a wide range of important micro-organisms and fungi while Pro-Plant contains many of the major and minor minerals of fertile soil.
  - In contrast. NPK and Urea contain just potassium, nitrates, and phosphates.
- When used year after year NPK, Urea and chemical sprays weaken the soil and kill off the micro-organisms that make soil fertile and full of life.
  - As a result, farmers have to keep feeding the plants high amounts of Nitrogen to keep them going.
  - It is a bit like a drug addict having to keep taking the drug he is addicted to in order to “keep going”.

The Effect of Bio-Plant on the Soil

- Bio-Plant and Pro-Plant can restore in 3 years the fertility of soil weakened by many years of chemical agriculture.
- Bio-Plant contains the micro-organisms that plants need to grow healthily, and which soil needs to be fertile.
- The micro-organisms in Bio-Plant increase the quantity of nutrients available to plants, and which are crucial for the overall productivity of the soil, by dissolving the NPK deposits left by chemical fertilizers.
  - About 80% of chemical fertilizer nutrients are unabsorbed by the roots. Micro-organisms make them available to the roots.

They Increase the Quality of the Soil

- By filling the soil with microbial life and providing all the nutrients required by the plants, they help to increase the quality of the soil with a natural micro-organism environment.
- They help build up the micro flora and in turn also the soil's health in general.
- In contrast, chemical agriculture destroys this environment and thereby weakens the health of the soil.

They Make the Soil Crumbly, Soft, and Rich

The Effect of Pro-Plant on Plants

- When the minerals and nutrients of Pro-Plant are sprayed onto the leaves, they are absorbed by the plants very efficiently.
- Spraying with a fine, misty spray pointed diagonally upwards before 9 a.m. is best because then the pores of the leaves are open and the minerals can enter the leaves through the stomata.
- As a result, the plants obtain a large amount of nutrients and can use them immediately.

The Effect of Chemicals on the Soil

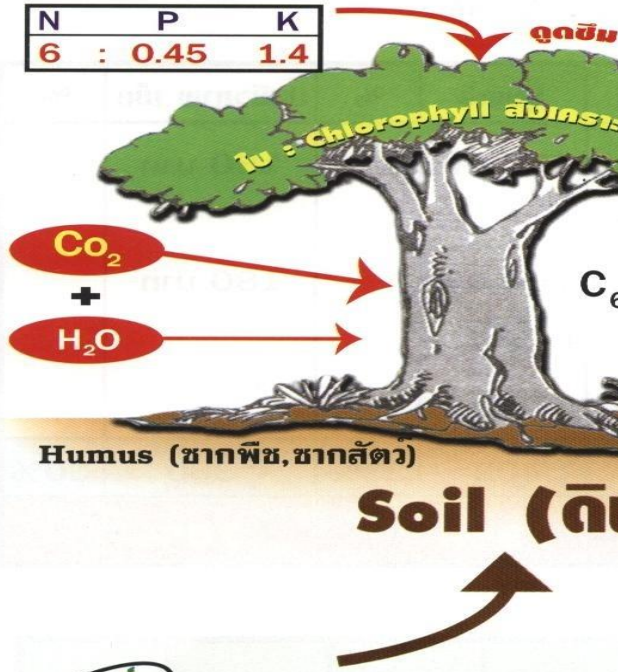
In contrast, only about 20% of the chemicals of NPK, UREA, etc., actually make it into the plants through the roots.

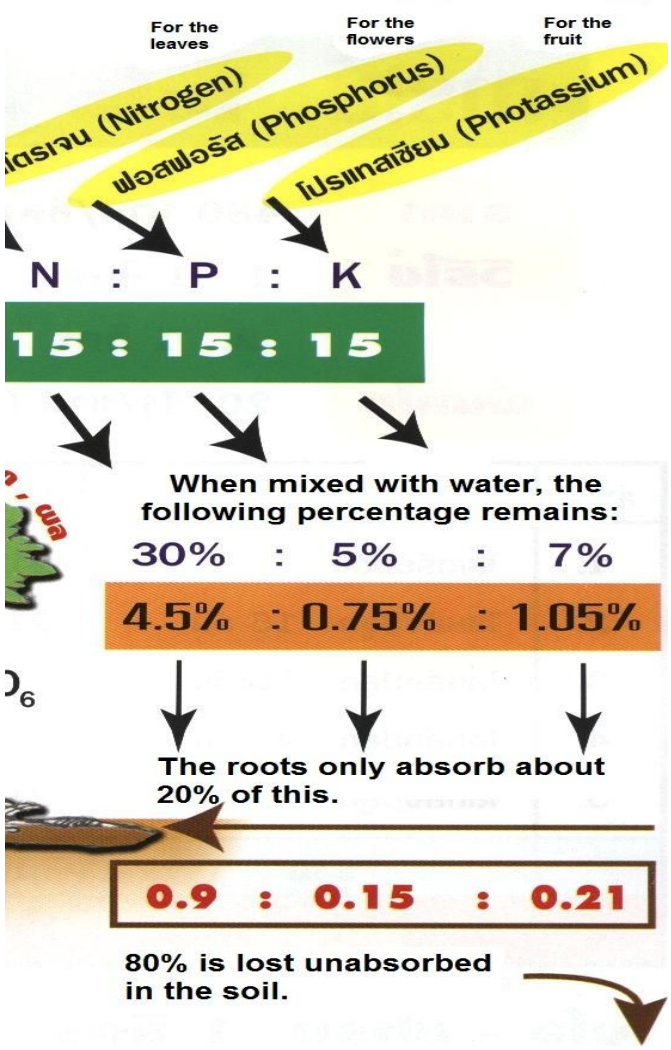
They remain in the soil unabsorbed.

โปร - ฟาร์ม Pro-Farm (Pro-Pl

ใช้ (Use) 1 ลิตร : 1,000 ลิตร (litres) of v

N	P	K
6	0.45	1.4





reparation

itre of Bio-Farm (or Bio-Plant) with 5 MT of organic
and leave for 2 weeks before planting the crop.

nemical Farming

0 cc of Bio-Farm (or Bio-Plant) with a 50 kgs bag of
r NPK. Then you can use the 50 kgs bag over twice
ual area.

its

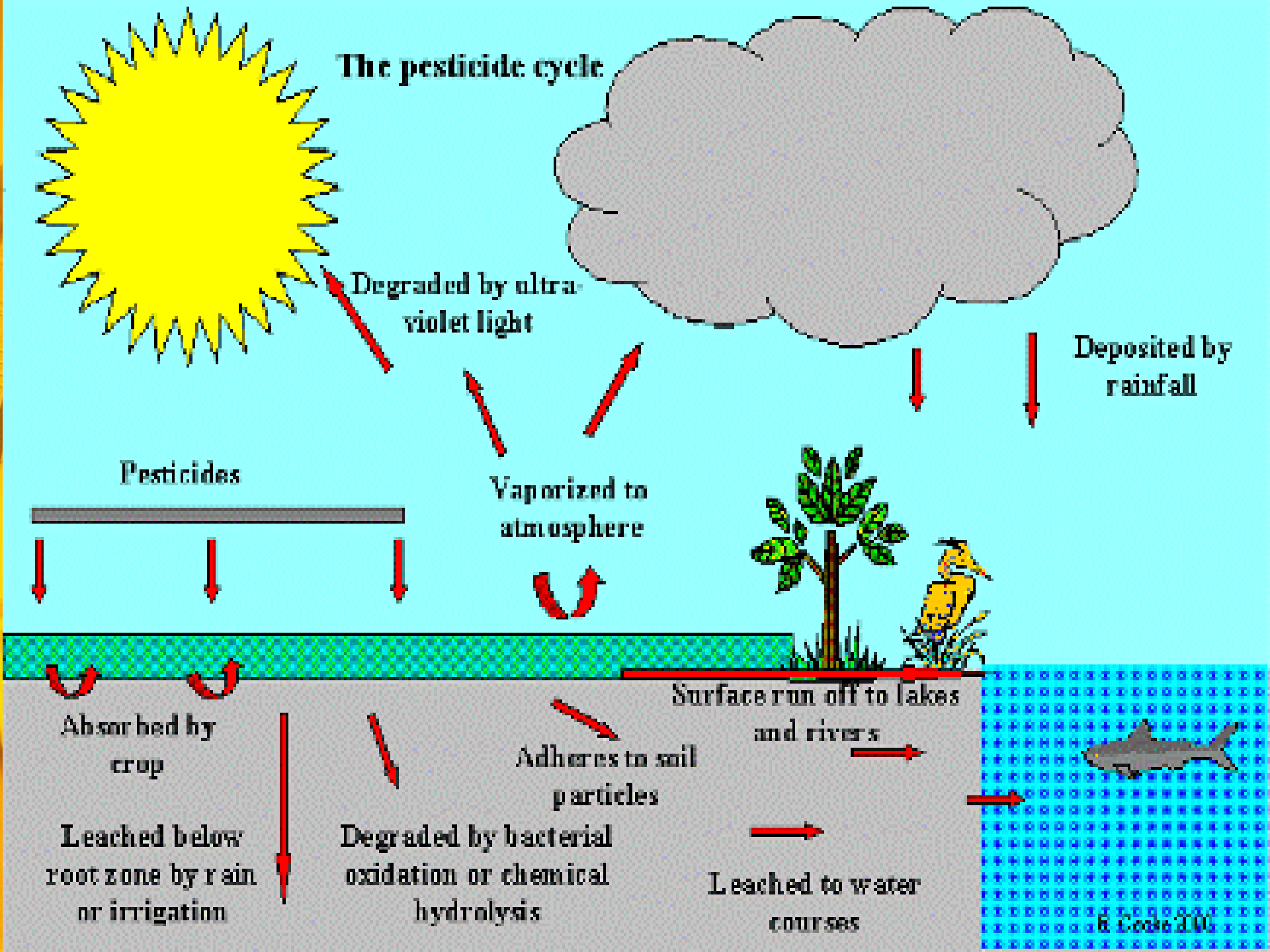
ro-organisms sweep up the 80% of the NPK that is left
rbed in the soil and make it available to the roots; fix extra
n from the air; and strengthen the plant's immune system
nificantly. The soil becomes crumbly, fertile and alive again.

The Effect of Chemicals on the Soil

- When it rains, the remaining nitrates and sulphur form Nitric acid and Sulphuric acid, amongst others, which make the soil more and more acidic, and these acids kill off the microbial life.
- Gradually the soil hardens as the microbes that aerate the soil die, and the soil loses its fertility.

The Effect of Chemicals on the Plants

- As this process gathers momentum, more and more chemical fertilizer has to be applied to produce the same yield as a few years before because the microbes that provided the Nitrogen naturally have been depleted.
- In the meantime, harmful bacteria increase, the plant's immune system weakens, diseases and pests appear and attack the plants, and more and more pesticides and insecticides have to be used.
  - The harmful effect of pesticides is shown on the next slide.


The pesticide cycle
Degraded by ultra violet light
Deposited by rainfall
Pesticides
Vaporized to atmosphere
Surface run off to lakes and rivers
Absorbed by crop
Adheres to soil particles
Leached below root zone by rain or irrigation
Degraded by bacterial oxidation or chemical hydrolysis
Leached to water courses
K Code 2006

The Bio-fertilizers Obtain an Abundant Amount of Nitrogen for the Plants

- Bio-Plant provides the soil with micro-organisms that fix Nitrogen from the air.
- The right amount of Nitrogen that a plant needs is absorbed from the air into the leaves.
- Pro-Plant provides additional Nitrogen.
- Urea / NPK / etc., however, provide too much at one time, which is bad for the plants, and causes stress.

The Bio-fertilizers Obtain an Abundant Amount of Nitrogen for the Plants

- The micro-organisms in Bio-Plant enable a plant to provide through soil processes or by fixing it from the air all the Nitrogen it needs daily.
- They turn into a useable form the large amount of NPK deposits that are in the soil unused as a result of many years of chemical farming.
  - The plants get more NPK by means of the micro-organisms in Bio-Plant than is put into the soil by chemical fertilizers.

Chemical Farmers Must Add More and More Chemical Fertilizers Each Year

- The high Nitrogen-fix of chemical fertilizers is only needed because the soil has been weakened so much by the over-use of chemicals that it needs high Nitrogen-fixes to produce a decent yield.
  - It is a bit like flogging a dying donkey to pull a load.
- It makes so much better business sense to restore the soil's fertility so that it does not need the Nitrogen-fixes.
  - In this way, the farmers will make more money.

Toxic Chemical Sprays Can Be Phased Out

- Also, farmers do not need to use toxic pesticides as the bio-fertilizers increase the plant's immunity to insects, and break the life cycle of harmful insects in a natural way.
- Non-toxic sprays can be made from tobacco mixed with the bio-fertilizers, and in this way farmers can stop using toxic sprays that kill the microbial life of the soil.

The Negative Effects of Chemical Fertilizers

- After the introduction of chemical fertilizers in the last century, farmers were happy to get increased yield in agriculture in the beginning.
- But slowly chemical fertilizers started displaying their ill-effects, such as:
  - leaching out chemicals and polluting water basins;
  - destroying micro-organisms and friendly insects;
  - making the crop more susceptible to the attack of diseases;
  - reducing the soil fertility;
  - and thus causing irreparable damage to the overall system.

The Benefits of Bio-fertilizers

- Bio-fertilizers, such as Bio-Plant and Pro-Plant, help to increase the yield without causing the damage associated with chemical fertilizers.
- Bio-fertilizers improve the fertility of the land and do not contain any chemicals which are detrimental to the living soil.
- They are extremely beneficial in enriching the soil with those micro-organisms, which produce organic nutrients for the soil and help combat diseases.
- The farm produce does not contain traces of hazardous and poisonous materials.

Chemically depleted soil on the left VS nutrient-rich organic soil on the right.

The Contrasting Effects on the Soil

- Bio-fertilizers differ from chemicals fertilizers in that they feed the plants while adding organic material, microbial life, and major and minor nutrients to the soil.
  - Soils with lots of organic matter and microbial life remain loose and airy, hold more moisture and nutrients, foster growth of soil organisms, and promote healthier plant root development.
- If only chemicals are added, the soil gradually loses its organic matter and micro-biotic activity.
  - As the organic matter is used up, the soil structure deteriorates, becoming compact, lifeless and less able to hold water and nutrients. This results in increased amounts of chemical fertilizers needed to feed plants.

11. What is a Bio-fertilizer?

The Nature of a Bio-fertilizer

- Bio-fertilizer is a 100% natural and organic fertilizer that helps to provide all the nutrients and micro-organisms required for the benefits of the plants.
- It contains a large population of beneficial micro-organisms that enhance the productivity of the soil and increase plant growth either by fixing atmospheric Nitrogen or by solubilising minerals in the soil, including those unabsorbable by roots, and by stimulating plant growth through the synthesis of growth-promoting substances.

How a Bio-fertilizer Helps the Soil

- The term “bio” means living; so bio-fertilizers are made up of living, microbial inoculants that are added to the soil.
- Micro-organisms create a micro environment around the roots of plants that makes nutrients easily available to the plants, and helps to retain water.
- When you use chemical fertilizers and chemical sprays, however, most of these micro-organisms die forever, and as a result the soil loses its capacity to provide sustainable growth in the long term.

The Usefulness of Bio-fertilizers for the Soil

- Bio-fertilizers can be used on the soil as a high quality organic fertilizer and as a corrector of pH, bacterial life, and texture. They also have a relatively high nutrient concentration, and can be used to prepare the soil before planting.
- Bio-Plant, for example, is especially effective in soil preparation when mixed with organic matter. The micro-organisms feed rapidly on the organic matter and multiply rapidly.
- The organic matter becomes like a factory mass-producing micro-organisms, which spread out and fertilize the soil.


Dry
Dead
Wet
Alive
Common Soil
Sterile
1 billion bacteria
per teaspoon

The Micro-organisms Increase Phosphate Availability for the Roots

- The advantages of using bio-fertilizers are enormous. Not only are they very economical, but they produce high agricultural yields.
- Bio-fertilizers include phosphate-solubilizing microbes. Phosphorus is an important nutrient for plants. There are several micro-organisms which can solubilize the common sources of phosphorus, such as rock phosphate.
- They solubilise the bound phosphorus and make it available to the plant, resulting in improved growth and yield of crops.

How the Micro-organisms Increase Phosphate Availability for the Roots

- Soil phosphates are rendered available to plants by soil micro-organisms through the secretion of organic acids. In this way, phosphate-dissolving soil micro-organisms play an important part in correcting phosphorus deficiency in the soil.
- They may also release soluble inorganic phosphate into the soil through the decomposition of phosphate-rich organic compounds.

Bio-fertilizers Enrich the Soil and Improve Seed and Root Growth

- Bio-fertilizers improve soil fertility and enhance nutrient uptake and water uptake in deficient soils, thereby improving the establishment of plants.
- Bio-fertilizers also secrete growth substances and antifungal chemicals, as well as improve seed germination and root growth.
- The combined effects of phosphorus- and potassium-mobilizing micro-organisms and specific nitrogen-fixing bacteria enrich the soil and cost less than chemical fertilizers, which harm the environment and deplete non-renewable energy sources.

Bio-fertilizers Improve the Soil's Health

- Bio-fertilizers decompose organic material and help to build up the micro-flora, which in turn improves the health of the soil, enhances the growth of plants, and increases the yield of crops.


Soil Which Is Rich in Micro-organisms

Bio-fertilizers Provide More Than NPK

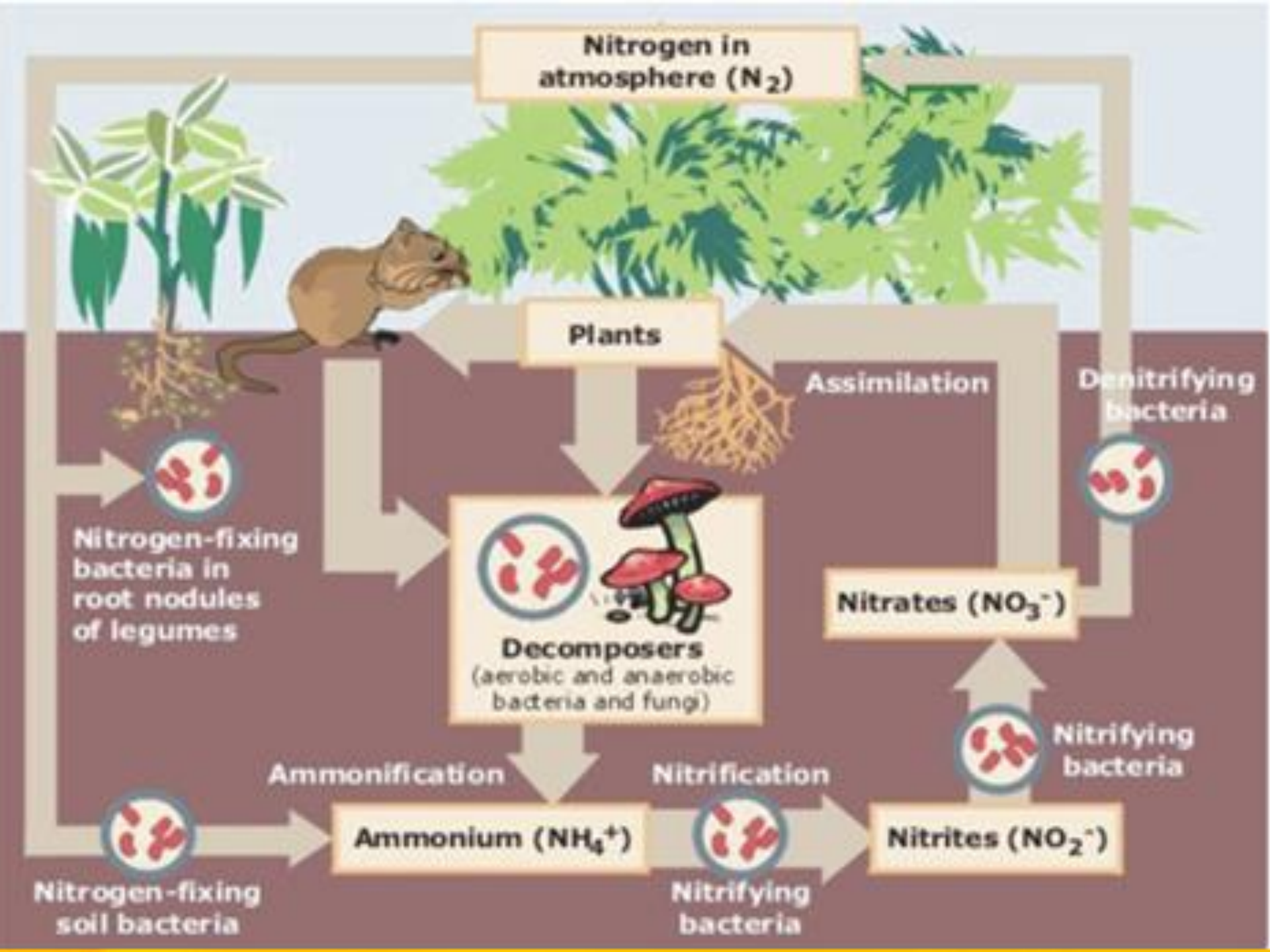
1. Chemical fertilizers supply an abundance of Nitrogen, and depending on the kind, also Phosphorus and Potassium, whereas bio-fertilizers provide in addition to these major minerals, minor minerals, certain growth-promoting substances, such as hormones, vitamins, amino acids, etc.

Bio-fertilizers Supply Nitrogen Abundantly

- Chemical crops have to be provided with chemical fertilizers repeatedly to replenish the loss of Nitrogen utilised for crop growth.
  - One reason for this is that chemical agriculture kills off the microbial life that provides the plants with the Nitrogen they need, thereby making them dependent on chemical “fixes” of Nitrogen.
- Bio-fertilizers, however, supply the Nitrogen continuously through natural processes throughout the entire period of crop growth in the field under favourable conditions.
  - Bio-Plant has micro-organisms which fix Nitrogen from the air as well.

Bio-fertilizers Restore the Soil's Natural Processes

- Continuous use of chemical fertilizers adversely affects the soil structure by killing off soil micro-organisms and thereby disrupting essential processes *(see diagram below)* that create fertile soil.
- Bio-fertilizers provide chemical soil the micro-organisms that restore these processes and thereby improve the soil structure.


Nitrogen in atmosphere (N_2)
Plants
Assimilation
Denitrifying bacteria
Nitrogen-fixing bacteria in root nodules of legumes
Decomposers
(aerobic and anaerobic bacteria and fungi)
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria

Chemical Agriculture is Unsustainable

- Chemical fertilizers are toxic at higher doses. Bio-fertilizers, however, have no toxic effects.
- Modern agriculture is getting more and more dependent upon the steady supply of chemical fertilizers, which are products of fossil fuel (coal + petroleum).
- The excessive dependence of modern agriculture on chemicals and the adverse effects being noticed due to their excessive and imbalanced use has compelled the scientific fraternity to look for alternatives.
- Bio-fertilizers provide a natural and effective alternative, and produce higher yields for a lower cost.

Bio-fertilizers Build Up the Micro-Flora

- Bio-fertilizers are ready-to-use live formulates of beneficial micro-organisms, which on application to the seeds, roots, or the soil mobilize the availability of nutrients by their biological activity in particular, and help to build up the micro-flora, which is turn improves the soil's health in general.

Bio-fertilizers Fix Nitrogen From the Air

- Certain micro-organisms harvest (fix) atmosphere nitrogen and convert it into ammoniac form, which in due course is made available to the plants or is released in the soil.
- Phosphate-dissolving micro-organisms solubilize fixed forms of phosphorus already present in the soil and make it available for use by the plants.
- Bio-fertilizers are also used for hastening the process of composting and for enriching its nutrient value.

Effect of Achromobacter Micro-organisms

- Achromobacter micro-organisms produce cytokinin, which increases the surface area per unit root length and is responsible for root hair branching. This enables the roots to absorb more nutrients.
- Micro-organisms dissolve NPK deposits in the soil, increase the amount of chlorophyll, and increase the assimilation of minerals.

Summary of the Main Benefits of Bio-fertilizers for Plants

- Bio-fertilizers differ from chemicals fertilizers in that they feed your plants while adding organic material, microbial life, and major and minor nutrients to the soil.
- Soils with lots of organic matter and microbial life remain loose and airy, hold more moisture and nutrients, foster growth of soil organisms, and promote healthier plant root development.
- If only chemicals are added, the soil gradually loses its organic matter and micro-biotic activity. As the organic matter is used up, the soil structure deteriorates, becoming compact, lifeless and less able to hold water and nutrients. This results in increased amounts of chemical fertilizers needed to feed plants.

12. Comparison of Costs by Type of Farming

Financial Benefits for the Farmers

- Farmers of 3-month crops use about six 50 kgs. bags of Urea & NPK per hectare per season.
- At the market price of US$38 per bag, this would cost the farmer US$228 to buy the required amount.
- Per Hectare: By mixing Bio-Plant with the chemical fertilizer, the farmers would use 3 bags instead of 6 bags (US$114) + 3 x 165 cc (0.5 litre) of Bio-Plant with Urea + 3 x 165 cc (0.5 litre) of Bio-Plant with NPK (US$18) = US$132, which is a 42% saving.
- **Note:** US$18 per litre is an average selling price to farmers in 2016.

Option 1

100% Organic Farming (3-month Crop)

	Bio-Plant (Used in Soil Preparation)	Pro-Plant (Sprayed on the Leaves)	Cost of Bio-Plant and Pro-Plant	Cost of Chemical Fertilizer (Excluding Chemical Sprays) Urea NPK	Savings
Standard Mix Ratio (20 litres of water)	1 litre per 5 MT of Organic Matter per hectare.	20 cc	-	-	-
Area : 1 acre	0.5 litres	250 cc x 5 sprays = 1.25 litres	US$31.5	US$38 x 1.5 bags = US$57 US$38 x 3 bags = US$114 = US$171	**US$139.5**
Area: 1 hectare	1 litre	500 cc x 5 sprays = 2.5 litres	US$63	US$38 x 3 bags = US$114 US$38 x 5 bags = US$190 = US$304	**US$241**
Notes	**Cost of Fertilizer:** Bio-fertilizer (US$18 per litre in this calculation – average 2017 selling price) and Urea / NPK / etc. (an average price of US$38 per 50 kgs bag is used). **Amount:** The amounts of Urea & NPK are 1 bag per acre each and 3 bags per hectare each. Add the cost of chemical sprays. Sprays are not needed with Bio-Plant and Pro-Plant. **Application:** Bio-Plant is mixed with organic matter, and applied to the soil. Pro-Plant is sprayed on the leaves. **Area:** 1 acre = about 4,046 square metres. 1 hectare = 10,000 square metres.				

Option 2

Bio-chemical Farming 1 (3-month Crop)

	Bio-Plant (Mixed with Urea / NPK)	Urea / NPK (Mixed with Bio-Plant)	Cost of Bio-Chemical Fertilizer Over Same Area as Chemical Fertilizer	Cost of Chemical Fertilizer (Urea / NPK) (Excl. Chemical Sprays)	Savings
Standard Mix Ratio (per 50 kgs bag)	330 cc	-	US$6 + U$38 = US$44 (The bag can then be used over double the normal area, so there is a big saving.)	-	-
Area : 1 acre	165 cc 165 cc	0.5 bag 0.5 bag	US$3 + US$19 = US$22 US$3 + US$19 = US$22	US$38 x 1 bag= US$38 US$38 x 1 bag = US$38	**US$32 (42%)**
Area: 1 hectare	0.5 litre 0.5 litre	1.5 bags 1.5 bags	US$9 + US$57 = US$66 US$9 + US$57 = US$66	US$38 x 3 bags = US$114 US$38 x 3 bags = US$114	**US$96 (42%)**
Notes	**Cost of Fertilizer:** Bio-fertilizer (US$18 per litre in this calculation – average 2017 selling price) and Urea / NPK / etc. (an average price of US$38 per 50 kgs bag is used). **Amount:** The amounts of Urea & NPK are 1 bag per acre each and 3 bags per hectare each. Add the cost of chemical sprays. Sprays are not needed with Bio-Plant and Pro-Plant. **Application:** Bio-Plant is mixed with organic matter, and applied to the soil. Pro-Plant is sprayed on the leaves. 330 cc of Bio-Plant is mixed with each 50 kgs bag of Urea / NPK, and applied to the soil. In the same way as chemical fertilizer. This bag can then be used over twice the normal area. **Yield:** With only Bio-Plant the yield will increase about 10%. Often the increase is much more though.				

Option 3

Bio-chemical Farming 2 (3-month Crop)
(Option 2 + Spraying Pro-Plant)

	Bio-Plant (Mixed with Urea / NPK)	Pro-Plant (Sprayed on the Leaves)	Cost of Bio-Chemical Fertilizer Over Same Area as Chemical Fertilizer	Cost of Chemical Fertilizer (Excl. Chemical Sprays)	Savings
Standard Mix Ratio (per 50 kgs bag)	330 cc	500 cc is mixed with 500 litres per hectare.	US$6 + U$38 = US$44 (The bag can then be used over 2X normal area.)	-	-
Area : 1 acre	165 cc 165 cc	250 cc x 5 sprays = 1.25 litres	US$3 (BP) + US$19 (urea) US$3 (BP) + US$19 (NPK) US$22 (PP) = US$66	US$38 x 1.5 bags = US$57 US$38 x 1.5 bags = US$57 = US$114	**US$48 (42%)**
Area: 1 hectare	0.5 litre 0.5 litre	500 cc x 5 sprays = 2.5 litres	US$9 (BP) + US$57 (urea) US$9 (BP) + US$57 (NPK) US$45 (PP) = US$159	US$38 x 3 bags = US$114 US$38 x 3 bags = US$114 = US$228	**US$69 (30%)**
Notes	**Cost of Fertilizer:** Bio-fertilizer (US$18 per litre in this calculation – average 2017 selling price) and Urea / NPK / etc. (an average price of US$38 per 50 kgs bag is used). **Amount:** The amounts of Urea & NPK are 1 bag per acre each and 3 bags per hectare each. Add the cost of chemical sprays. Sprays are not needed with Bio-Plant and Pro-Plant. . **Application:** Bio-Plant is mixed with organic matter, and applied to the soil. Pro-Plant is sprayed on the leaves. 330 cc of Bio-Plant is mixed with each 50 kgs bag of Urea / NPK, and applied to the soil. In the same way as chemical fertilizer. Pro-Plant is mixed with water and sprayed on the leaves. 500 cc of Pro-Plant is mixed with 500 litres of water per hectare. 250 cc is mixed with 250 litres of water per acre. **Yield:** The total yield will increase more and more each year.				


The End