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Dear Sirs,

Subject: Effects of Bio-Plant and Pro-Plant on Various Crops Including Rice

We are very grateful for your interest in how Bio-Plant and Pro-Plant could increase rice production in Nigeria.

General Benefits

Rice farmers in Thailand and Vietnam have been using these two bio-fertilizers for rice production for about 20 years now with great success. The usual benefits for rice are as follows:

- In bio-chemical farming, which chemical farmers tend to prefer to change over to, the yield usually increases by about 10%-20% in the first year (minimum 10%), and after about 3 years the increase is about 40% higher than chemical rice. The increase in yield is faster and higher when the farmers also prepare the soil with organic matter mixed with Bio-Plant. The costs drop by about 40% - 45% compared to chemical agriculture.
- In 100% organic farming the rate of increase in yield depends on how badly chemical farming has damaged the soil. As the soil's microbial life is restored the yield increases above chemical farming while the costs of the farmers are significantly lower, usually about 60% - 70%. You will see in some of the field tests below that the yield does increase in the field test 25%-40% straight away compared to a chemical control.
- The rice plants have about 20% more roots, the stems are much thicker and too thick for insects to bite through, there is more grain on the heads, and very few pest problems. Because the bio-fertilizers strengthen the immune system of the rice plants and make the rice crops healthy, insects do not show interest in the bio-fertilizer rice fields and go and attack weak, chemical rice fields instead.
- In addition, the farmers can stop using chemical sprays completely by the second season because the immune system of the rice plants has become stronger as the soil's microbial life is restored. After one or two seasons rice farmers stop using the sprays, though they can stop immediately if they wish to do so. Indeed, we ask them to do so.
- The taste of the rice becomes sweeter.
- The quality of the rice is much better than chemical rice.
- Our agents in Vietnam and Thailand say that there are more and more chemical farmers are wanting to change from chemicals to Bio-Plant and Pro-Plant each season. We shipped 16 more 20-foot containers of the bio-fertilizers to Vietnam in the last month alone, which indicates their effectiveness and popularity. We sell the bio-fertilizers under different brands because there are many agents wanting to market the bio-fertilizers because of their high demand in the country.

Training Farmers

After a sale we will go to Nigeria to teach the rice farmers how to use the bio-fertilizers to phase out chemical rice farming, and hold workshops to train people who will then teach the farmers when we are

not in the country. Whenever a new shipment arrives in the country, we will go to Nigeria to train farmers again.

Once the farmers have started to use the bio-fertilizers, we can show the farmers how to increase the multiplication of the micro-organisms so that the microbial life of the soil becomes stronger and the soil becomes more fertile. But we would need to do this step by step.

The Request for Thai and Vietnamese Farmers

We realize that you would like us to send over from Thailand and/or Vietnam up to 10 rice farmers, and we do not wish to appear uncooperative, but it would better, we feel, if one of our agents carried out any required field tests on rice first in order to demonstrate the effectiveness of the bio-fertilizers with rice. The bio-fertilizers are easy to use, and indeed, one of our agents carried out very successful field tests on maize in Gombe State by just following the written guidelines. *(Please see pp. 25-31.)*

We are offering each state in Nigeria the Credit Fund, which you will be aware of, in order to phase out chemical agriculture, and this includes replacing chemical rice production with bio-chemical and 100% organic rice production. We hope that once you have seen the effects of the bio-fertilizers on rice, the state government will wish to accept the Credit Fund. After a contract has been signed, we will be able to start the process of transferring the bio-technology to your state and increasing rice production.

Bio-technology Services

Once the farmers are using the bio-fertilizers, we can help the government in other ways. For example:

1. We can combine the strengths of rice seeds in the country at the DNA level according to the needs of each state. This will increase rice production further.
2. We can change the micro-organisms used in Bio-Plant, or add additional bacteria according to the needs of the soil or state. For example, if the soil had oil deposits in it, we could adjust the micro-organisms in Bio-Plant so that the oil deposits are dissolved.
3. By helping the farmers to improve the quality of their seeds in various ways, we will enable the state not to have to resort to harmful GMO rice seeds, which not only increase the costs of the farmers, but also cause many problems.

If you have any questions, please let our agent know. We hope that we will be able to help your state's farmers to increase their rice production soon.

My warmest regards,



Mr. Peter McAlpine
Marketing Manager
Artemis & Angel Co., Ltd.
For Somkiet Panjanapongchai, President, Artemis & Angel Co., Ltd.



Some Evidence of the Beneficial Effects of Bio-Plant and Pro-Plant 100% Organic, Microbial, Liquid Bio-fertilizers

1. Introduction

- Here is a summary of some field test results carried out in the last few years from Mauritius, Thailand, Vietnam, Benin, Cameroon, Nigeria, Malawi, Namibia, Rwanda, China, Azerbaijan, Bangladesh, Nepal, Malaysia, Philippines, and Indonesia. These are just to give you an idea of the general cost and yield benefits of using the bio-fertilizers.
- We have many, many field test results in Thai and Vietnamese, but we have not translated these because nobody pays much attention to the field tests of other people, including tests carried out by government research centres, and they wish to carry out their own tests.
- Many farmers have been using the bio-fertilizers for up to about 13 years, and we do not keep a record of their results. However, the orders increase continuously because of the beneficial effects, and now already several governments are buying the two bio-fertilizers in order to phase out chemical agriculture.
- The government of Ghana has agreed to our Credit Fund offer of US\$100 million over 5 years after seeing 3 years of use in fields.
- The information below is authentic.

2. General Comments

- ***In bio-chemical farming***, as a general rule, by mixing 330 cc of Bio-Plant with each 50 kgs bag of chemical fertilizer in bio-chemical farming enables farmers to halve the amount of chemical fertilizer they use straight away while increasing their yield and reducing their costs by at least 40%.
- If they also prepare the seeds and soil with Bio-Plant and spray Pro-Plant on the leaves, the yield will rise by about 25%-30% in the first use while the costs drop by about 30%. The increase in yield varies and increases each season as the soil recovers.
- In Year 2 and Year 3 they can reduce the amount of chemical fertilizer in each year by another 25% until they are farming 100% organically with a higher yield than when they were farming with chemicals, and of course, with much lower costs. We suggest this rate of change because even hardened chemical farmers can accept it.
- The drop in costs depends on the cost of chemical fertilizer in the country.
- ***In 100% organic farming***, the yield increase varies so much with yields even doubling, but an increase of about 30% is most common to begin with. The yield increases each year as the soil is restored to fertility and the bio-fertilizers clean the soil of the unabsorbed chemical NPK deposits left by chemical fertilizers.
- The costs are much lower. Sometimes we meet farmers who have told us that they are making a good profit for the first time as their costs have dropped 60% - 75% since they have stopped using chemical fertilizer.

3. General Benefits of Bio-Plant Reported in Field Tests

- Bio-Plant restores soil fertility, and makes hard chemical fertilizer soil crumbly and rich again. This is because Bio-Plant contains a high concentration of quickly multiplying soil micro-organisms and fungi.
- The micro-organisms produce NPK for plants and stimulate plant growth.

- The micro-organisms make the NPK soil deposits left by chemical fertilizer absorbable by the roots.
- It improves root system development.
- When used with Pro-Plant it increases the fragrance of flowers and sweetness of fruit, rice, and other grains.
- When mixed with chemical fertilizer, it halves the amount of chemical fertilizer farmers need.
- Bio-Plant makes rich bio-compost when mixed with organic matter.
- It strengthens the plant's immune system and resistance to disease and pests.
- It breaks the life cycle of soil pests.

4. General Benefits of Pro-Plant Reported in Field Tests

- Pro-Plant increases the quality and quantity of the crop yield, and thereby increases income.
- Pro-Plant accelerates growth, flowering, and the formation of grain, fruit, etc. The nutrients are useable instantly by the leaves, especially when sprayed in a fine mist onto the leaves before 9 a.m.
- Pro-Plant makes plants much healthier, and more resistant to diseases and pests.
- Increases the fragrance of flowers, the sweetness of fruit and sugarcane, the crispiness of vegetables, and flavour.
- It increases the absorption rate of nutrients.
- Pro-Plant stimulates the respiratory and photosynthesis systems, so that the plant can absorb nutrients as needed.
- It also supplements carbon dioxide fixing.
- It helps to improve the soil structure.

5. Some Field Test Results

5.1 Azerbaijan

Various Kinds of Vegetables: Field tests on *various kinds of vegetables* were carried out in 100% organic farming and bio-chemical farming formats, and the results were very good when compared to chemical fertilizers. The average increase in yield was about 25% in 100% organic farming and 35% in bio-chemical farming with much lower costs.

5.2 Bangladesh

Two tests have been carried out with *tea*.

- **Tea Test 1:** The test was carried out in a pretty well dead area of a tea plantation and the tea plants recovered to give a good yield. Continuous use of chemical fertilizers had caused the condition of the tea plantation to deteriorate.
- **Tea Test 2:** After spraying Pro-Plant on Day 1, Day 8, and Day 15 the yield was 20% higher than what chemical fertilizers achieved. The leaves grew faster, and were thicker, longer, and greener. This happened again in the next 2 picking periods. The farmer's profit margin was much higher than usual with chemical fertilizers, but the agent could not say how much.
- These results are fairly standard as the same level of results is obtained commonly in Thailand and Vietnam when compared to chemical fertilizers. The increase is usually about 20% more when there is proper soil preparation with Bio-Plant.
- **Various Crops:** Other tests have been carried out to show the benefits in bio-chemical farming, leading to a large volume of sales.

5.3 Benin

- **Carrots:** In bio-chemical farming the yield of *carrots* was about 35% higher with costs down by about 35%.
- **Various Crops:** Many bio-chemical farming and 100% organic farming field tests were held in Benin from 2007 - 2009. Once we were able to get the farmers to follow the guidelines properly, such as by preparing the soil with organic matter mixed with Bio-Plant, and spraying the crops every 10 days or 14 days according to the guidelines, the results were always better than what they had experienced in their chemical farming with regards to yield and costs.

5.4 Cameroon

- **Tomatoes:** Bio-chemical farming tests on tomatoes reduced the farmers' costs by around 70%.

5.5 China

- **Tobacco:** Field tests on *tobacco* in Yunnan province, China, showed a 30% - 40% increase in yield in 100% organic farming compared to chemical fertilizers with much lower costs. The leaves were larger, longer, and fresher-looking.
- **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.

5.6 Indonesia

- **Rice:** The results of government field tests on rice in Indonesia came out as "excellent" 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 than with chemical fertilizer.

5.7 Kenya

- **Maize and Rice:** The results of field tests carried out by the K.A.R.I. Research Institute in Kenya in 100% organic farming and bio-chemical farming with *maize and rice* were very good compared to chemical fertilizers. The increases averaged around 30% compared to chemical farming.

5.8 Malawi

- **Maize:** Field tests over 3 seasons on maize on soil with a high level of Mn and Fe showed much better growth in terms of yield, colour, and healthiness. 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 three rounds of field tests on maize, which finished in early 2012, were excellent.
- **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 ¹Plant Pathology Section, Bvumbwe Agricultural Research Station**

Soil Test Results

- The results indicated that there were significant differences ($P \geq 0.5$) between bio-organic and bio-chemical farming. The mean of pH, OM, and N were higher in bio-organic than in bio-

chemical, 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.

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 above the control at both sites Bembeke and Bvumbwe.
- The combined use of 30% chemical fertilizer and 660cc of Bio-Plant microbes gave the highest maize grain yields of 5514 kg/ha at Bvumbwe and 4883 kg/ha at Bembeke.
- Bio-organic farming gave the highest grain yields at Bvumbwe (3518 kg/ha) and Bembeke (3667 kg/ha). The significant differences in grain yield were due to the effects of the Bio Plant and Pro Plant in the treatments.
- This means that Bio Plant and Pro Plant microbes mineralized and fixed more soil and atmospheric N respectively and made them available to the crops for uptake.
- The bio-fertilizer further enhanced the availability of soil macro (such as P and K) and micro (such as Mg, Zn, etc) nutrients, their uptake and use efficiency by the maize plants as compared to the treatment where 300 kg/ha of chemical fertilizer alone were applied and got slightly lower yields at Bvumbwe.
- This suggests that bio-chemical treatments with the bio-fertilizers were more effective at producing the highest maize grain yields as compared to the rest of the treatments.

Conclusion and Recommendations

- Bio Plant and Pro Plant bio-fertilizers significantly improved soil fertility and available 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.
- The rate of 300cc Bio Plant plus 300cc Pro Plant in 420L of water mixed with 3000 kg Organic material per hectare in bio-organic farming and the rate of 990cc Bio Plant plus 150 kg (100 kg 23:21:0+4S; 50 kg Urea) fertilizer gave the optimum maize grain yield production at Bembeke.
- The rate of 660cc Bio Plant plus 100 kg (67 kg 23:21:0+4S; 33 kg Urea) fertilizer in Bio-chemical farming and rate of 300cc Bio Plant plus 300cc Pro Plant in 420L of water mixed with 3000 kg organic material per ha in bio-organic farming gave the optimum maize grain yield production at Bvumbwe.

5.9 Malaysia

- ***Tea, Rice, and Small Vegetables:*** Field tests on tea, rice, and small vegetables produced much better results in 100% organic farming and bio-chemical farming than the chemical Control crop. No numerical data was provided; just positive comments and a wish to buy the bio-fertilizers from some farmers.

5.10 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.

5.11 Myanmar

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

A. Test Area Using Bio-Plant and Pro-Plant over 8 acres.

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 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 for 8 acres = 72,000 + 32,000 = 104,000 Kyats = US\$104.
 - e. One cabbage weighed 4.8 kilos.
 - f. No need to use pesticides.

B. Control Area used inorganic, chemical fertilizer over 8 acres.

- a. Charcoal: 10,000 Kyats / acre = US\$10.
- b. Cow dung: 20,000 Kyats / acre = US\$20.
- c. Pesticide on Ground Carbofuran: 15,000 Kyats / acre = US\$15.
- d. Local organic 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.

5.12 Namibia

- **Rice and Millet:** Government field tests on *rice and millet* in Namibia showed “very good growth” in 100% organic farming compared to chemical fertilizers. As the agent wrote: “The results couldn’t possibly be better!! 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. Of course, over time, chemicals impoverish the soil whereas, over time, bio-fertilizers enrich the soil. ...”

5.13 Nepal

- **Rice:** 100% organic farming field tests with rice showed an increase in yield of about 30%.

5.14 Nigeria

- **Rice:** Tests on *rice* at the I.I.T.A. Research Institute in Ibadan have shown that Bio-Plant and Pro-Plant produce a higher quality yield for a lower cost than Urea and NPK. The tests are part of the pre-selection process for tests to be carried out by the Bill Gates Foundation. The institute has indicated that it will recommend the bio-fertilizers to the Foundation.

- **Maize:** Yield Result in bio-chemical farming using Bio-Plant and Pro-Plant:

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

- **Savings:** Around 30% as Pro-Plant was also used.

5.15 Pakistan

- **Various Vegetable Crops:** Field tests on *various vegetable crops* in Pakistan showed a noticeable increase in yield in 100% organic farming compared to chemical fertilizers ranging from about 20% to 100% with lower costs.
- **Flowers:** The 100% increase in yield was for *flowers* on an area of half an acre. The farmer had never obtained so many flowers before. Also, they had a better scent than flowers he grew with chemical fertilizers.
- **Cotton 1:** Even without soil and seed preparation using Bio-Plant, the performance of Bio-Plant and Pro-Plant with cotton has been satisfactory. At a demonstration plot at the Agriculture Research Institute the yield has been 880 kgs per acre during the first and second pickings, with two more pickings left. Conventional chemical farming has produced 720 kgs per acre. The costs are about 40% lower even with chemical fertilizer being heavily subsidized. With proper seed and soil preparation, the difference would be greater.
- **Cotton 2:** At a demonstration plot of Cotton at Matiari the yield was 30% higher than the conventional chemical farming yield of 750 kgs. Again, this was without seed and soil preparation with Bio-Plant.
- **Cotton 3:** Cotton Leaf Curl Virus has been creating devastation throughout the Punjab, but the test plot at Bhawalpur has been the least affected by the virus. This is the first application of the bio-fertilizers. Once Bio-Plant and Pro-Plant have been used for a couple of years, the immunity will be much stronger.

5.16 Philippines

- **Rice:** Organic farming field tests on rice have shown a 30% and 85% increase in yield. In the second of the tests the farmers prepared the soil according to the guidelines more effectively. We know that the production costs were significantly lower, but we do not know by how much.
- The Secretary of Agriculture (equivalent to the Minister) has seen the results in his own rice tests and is happy to endorse the bio-fertilizers.

5.17 Rwanda

- **Flowers:** Tests on roses resulted in fresher-looking and 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.

5.18 Thailand

- **General Results:** The bio-fertilizers have been used in Thailand for about 10 years already. Bio-chemical farming in Thailand using only Bio-Plant have shown many times that mixing 330 cc of Bio-Plant with a 50 kgs bag of NPK and Urea enables farmers to halve the amount of chemical fertilizer they use with a small increase in yield of no more than 10% compared to

chemical fertilizer. When Pro-Plant is sprayed on the leaves the average increase in yield is about 25%-30%. The percentage drop in costs is usually about 35%. These are common results.

- Farmers growing pineapple and bananas in the North of Thailand report the following general benefits after using Bio-Plant and Pro-Plant to grow their pineapple and bananas.

Pineapple

- The fruit is much sweeter than pineapple grown with chemical fertilizer.
- The pineapples are heavier.
- When you look at the pineapples, there have more eyes (scales) around the fruit.
- The pineapples look fresher and more attractive to eat.
- The pineapples keep longer after harvest.
- There are more suckers so that more pineapple plants can be planted and grown.
- The problems with disease disappear. In the first season the farmers can halve the amount of sprays they use, and in the second crop (second year) they can stop spraying chemical sprays altogether. The reason is that the immune system of the pineapple plants becomes stronger and stronger. Also, when the farmers spray Pro-Plant on the leaves and the fruit, the leaves and fruit get coated with micro-organisms, which protect the plants from disease.
- The cost of growing the pineapples drops significantly. In bio-chemical farming the farmers can halve the amount of chemical fertilizer they use, and if they also prepare the soil with organic matter mixed with Bio-Plant, and spray Pro-Plant over the plants every month (or every 2 weeks for better effects), they get a noticeable increase in yield. Usually the increase in yield, they say, is about 30%. This is standard for bio-chemical farming.
- After 3 years they can sell the pineapples as “100% Organic Pineapples”, and get a higher price.

Bananas

- The weight of bananas per tree is higher. Normally, the farmers spray Pro-Plant every month, but they say that the effects are better if they spray Pro-Plant twice or even three times per month.
- The bananas are sweeter than bananas grown with chemical fertilizer.
- The bananas look more attractive to buy and eat as the skin is shinier.
- The bananas don't have black spots on them.
- The bananas keep longer after picking.
- The farmers can sell the banana leaves for wrapping food because the leaves have more Cutin and look fresher and shinier.
- The problems with disease disappear. In the first season the farmers can halve the amount of sprays they use, and in the second crop (second year) they can stop spraying chemical sprays altogether. The reason is the same as outlined above with pineapples.
- The cost of growing the bananas drops significantly. As in the case of pineapple, in bio-chemical farming the farmers can halve the amount of chemical fertilizer they use, and if they also prepare the soil with organic matter mixed with Bio-Plant, and spray Pro-Plant over the banana trees every month (or every 10-14 days for better effects), they will get a noticeable increase in yield.
- The farmers stress the importance and benefit of preparing a lot of compost mixed with Bio-Plant and placing this around the banana trees. In the first year they took the recommendation of making up to 20 MT of compost and organic matter for each hectare, and they reaped the benefits of doing this. In the second year they could reduce the amount of organic matter they use as the soil has become rich in micro-organisms.
- After 3 years they can sell the bananas as “100% Organic Bananas”.

Grass

- The effect on a golf course was that the grass and the soil became softer and the growth was better. The same happens on lawns.

Pond Similar to a Golf Course Pond

- We chose a smelly pond in an area of farmland that was full of algae and rotting grass, and into which chemical fertilizer had seeped into. It was in a worse state to what one finds on a golf course in our experience.
- We applied 2 litres of Bio-Plant to the pond according to the volume of water, which we calculated to be about 200 tonnes, and after about 2 weeks when we went back the pond had become much cleaner. The smell had gone and the water was clearer. The chemicals had been consumed by the micro-organisms in Bio-Plant.
- Bio-Plant contains beneficial micro-organisms that clean polluted ponds. The micro-organisms consume the excess chemicals and nutrients that have come from the chemical fertilizers and pesticides used on the grass. They also break down the decaying vegetation and other organic matter that these nutrients are derived from, while at the same time releasing oxygen back into the pond.
- This introduction of increased oxygen levels creates two positive effects. Increased levels of oxygen in the water will cause the decomposition of organic matter to occur faster, thus limiting the amount of nutrients available and creating clearer water. Increased amounts of oxygen also squeeze out other gases like carbon dioxide and ammonia.

Tea

- Many farmers in the hills of North Thailand use the bio-fertilizers to grow tea. After spraying Pro-Plant on Day 1 and Day 8 during a 2-week leaf-picking period they obtain the following standard benefits:
 - The yield is a good 20% higher than with their chemical fertilizer tea, even when they do not prepare the soil with Bio-Plant and only spray Pro-Plant on the leaves. It is standard that the tea bushes produce more leaves and branches.
 - The leaves look fresher and shine more.
 - The tea has less tannin and tastes less bitter.
- Some farmers use bio-chemical fertilizer (NPK and Urea mixed with 330 cc of Bio-Plant) and spray Pro-Plant on Day 1 and Day 8, while others have stopped using chemical fertilizer and grow tea organically by preparing the soil with organic matter mixed with Bio-Plant and spraying Pro-Plant onto the leaves on Day 1 and Day 8.
- Comparing their results, the farmers using bio-chemical fertilizer and also spraying Pro-Plant get a slightly higher (5%) yields, but their costs are higher as they are using chemical fertilizer. Over time the difference in the yield disappears as the condition of the soil improves with continuous 100% organic soil preparation.

5.19 Vietnam

Sugarcane

- In general the farmers have increased their yield by about 30% compared to when they used chemical fertilizers.
- The sugar factories now only almost exclusively from farmers that grow their sugarcane crops with Bio-Plant and Pro-Plant, principally because the sugar from the sugarcane is sweeter than from chemical sugarcane (usually about 20% sweeter on analysis).
- Sugarcane crops grown in wet rice fields increased the yield by 40% - 50%.
- On normal land farmers increased normal yield of 50 tonnes per hectare to 70 tonnes.

- Bio-Plant and organic matter mixed together improve the soil. When flooded with water the sugarcane yield increased up to 100 tonnes. Where farmers use water system the yield increased up to 120 tonnes.
- They reduced their costs 30% - 35% compared to chemical fertilizers.
- Two 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. The sugar mills spray Bio-Plant mixed with water over the waste as it passes by on a conveyor belt, and the farmers use 5 MT per hectare to prepare the soil instead of urea.
- Farmers that mix Bio-Plant with chemical fertilizer halve the chemical fertilizer they use.
- Significant effect on the growth parameter (number of internodes per cane, internodal length, tops weight, trash weight and sucrose contents) and yield components (number of millable canes, cane length, cane diameter, weight per stripped cane and stripped cane yield).

Rubber

- At one Trimber rubber plantation the growth of young trees is 20% - 25% faster than normal, and the saplings can be transplanted a month earlier than normal.
- At another plantation the trees produce more latex than when chemicals were used in the past. The latex is softer and flows easier.

Rice

- Many chemical fertilizer rice farmers have stopped using Urea and NPK. Rice grown with Bio-Plant and Pro-Plant produces 25% - 40% more than with chemicals in 100% organic farming. The rice plants have more roots, more grain on the heads, and very few pest problems. Our agents say they have many more farmers wanting to change from chemicals to Bio-Plant and Pro-Plant next season.

Phasing Out Chemical Agriculture

- Many chemical farmers have gone through the 3-year process of changing from chemical farming to bio-chemical farming and then to 100% organic farming. Their revenue and crop yields are much higher and their costs much lower compared to their past when they were chemical farmers. Also, their soil is no longer hard and weak like it used to be in their chemical days.

Certification of the Accuracy of the Field Test Results

Wednesday, April 22, 2009

The field test and lab analysis report from the Benin National Institute for Agricultural Research, which is attached to the Ministry of Agriculture, Land, and Fisheries of Benin, has been translated from French to English. The company stamp is placed below as a guarantee of the accuracy of the translation.



Peter S. McAlpine
Marketing Manager
Artemis & Angel Co. Ltd.



อาร์ทีมิส
Artemis
& Angel Co., Ltd.
บริษัท อาร์ทีมิส แอนด์ แอนเจิล จำกัด



Republique du Bénin

Ministère de l'Agriculture, de l'Élevage et de la Pêche

Institut National des Recherches Agricoles du Bénin

Centre de Recherches Agricoles à Vocation Nationale Basée à Agonkanmey (CRA-A)
Laboratoire des Sciences du Sol, Eaux et Environnement (LSSEE) (ex-CENAP)

160 LSSEE/2005

ATTESTATION

Je soussigné AZONTONDE H. Anastase, Docteur ès-Sciences du sol, Spécialiste en fertilité du sol, Chargé de Recherches du CAMES, Responsable du Laboratoire des Sciences du Sol, Eaux et Environnement du Centre de Recherches Agricoles d'Agonkanmey, reconnais avoir fait analyser dans ledit Laboratoire un échantillon d'engrais liquide PRO-PLANT. Les éléments minéraux déterminés sont à des teneurs presque identiques (différence non significative) à celles qui sont marquées sur la boîte d'engrais qui a été remise au laboratoire.

Par ailleurs, un flacon du même engrais PRO-PLANTE et un autre flacon d'engrais BIO-PLANT ont été associés pour des essais sur la production du maïs. Les résultats ont été spectaculaires. Les parcelles traitées avec les deux produits ont eu un rendement de trois (3) tonnes à l'hectare pour le maïs variété DMR. Ce rendement est d'habitude obtenu sur un sol de fertilité moyenne auquel on apporte 200 kg/ha d'engrais NPK.

Les résultats d'analyse de l'engrais liquide PRO-PLANT sont consignés dans le tableau en annexe.

Fait à Agonkanmey , le 14/12/2005



Responsable du LSSEE

Dr. AZONTONDE H. Anastase

Republic of Benin Ministry of Agriculture, Land, and Fisheries

The Benin National Institute for Agricultural Research

160 LSSEE/2005

Certification

I, the undersigned, AZONTONDE H. Anastase, Doctor of Soil Sciences, specialist in soil fertility, in charge of CAMES research, responsible for the Laboratory of Soil Sciences, Water, and the Environment at the Agonkanmey Research Centre, acknowledge having analysed in the aforesaid laboratory a sample of the liquid bio-fertilizer Pro-Plant. The minerals contained are almost identical (insignificant difference) with those indicated on the box submitted to the laboratory.

Moreover, a bottle of the same bio-fertilizer Pro-Plant and another of the bio-fertilizer Bio-Plant have been used in field tests in the production of maize. The results were spectacular. The land treated with the two products produced three (3) tonnes per hectare of the maize variety DMR. This output was achieved on soil of average fertility on which 200 kg of NPK fertilizer is used.

The results of the analysis of the liquid bio-fertilizer Pro-Plant are shown on the table in the Annex.

Made in Agonkanmey on 14/12/2005

Responsible for the LSSEE

(Signature and Stamp)

Dr. AZONTONDEH. Anastase



Republique du Bénin

Ministère de l'Agriculture, de l'Elevage et de la Pêche

Institut National des Recherches Agricoles du Bénin

Centre de Recherches Agricoles à Vocation Nationale Basée à Agonkanmey (CRA-A)
Laboratoire des Sciences du Sol, Eaux et Environnement (LSSEE) (ex-CENAP)

N° 158 / LSSEE / 2005

Agonkanmey le, 15 Décembre 2005

RESULTAT ANALYTIQUE D'ENGRAIS LIQUIDE DEMANDEUR :
ARTEMIS ET ANGELO - BENIN

Répétition	N %	P ₂ O ₅ %	K ₂ O %	CaO %	MgO %	S %	Cl %	Zn ppm	Fe ppm	Cu ppm	pH	Mm
1	4,928	0,87	1,14	2,20	0,44	0,30	11,2	34,2	180,4	Trace	4,9	Trace
2	5,376	0,86	1,01	2,25	0,44	0,29	11,1	34,0	181,0	Trace	4,9	Trace
3	5,600	0,87	1,01	2,60	0,45	0,30	11,3	33,8	179,0	Trace	4,9	Trace



Le Responsable du Laboratoire

Dr.Ir. Anastase H. AZONTONDE

Certification About the Accuracy of the Thailand Field Test Results

Monday, August 16, 2010

The field tests have been translated from Thai to English. Farmers have been using Bio-Plant and Pro-Plant in Thailand for about 10 years, and nobody keeps field test results anymore as there is no need.

We have The translation is accurate according to the results of the field tests, which were issued by the relevant Thai provincial government authorities stated, which collected the field test data. The company stamp is placed below as a guarantee of this.



Peter S. McAlpine
Marketing Manager
Artemis & Angel Ltd.



อาร์ทีมิส
Artemis
& Angel Co., Ltd.
บริษัท อาร์ทีมิส แอนด์ แอนเจิล จำกัด

Summary of the Benefits of Using Bio-Plant and Pro-Plant In Thailand

General Effects

- The bio-fertilizers have been used in Thailand for about 10 years already. Bio-chemical farming in Thailand using only Bio-Plant have shown many times that mixing 330 cc of Bio-Plant with a 50 kgs bag of NPK and Urea enables farmers to halve the amount of chemical fertilizer they use with a small increase in yield of no more than 10% compared to chemical fertilizer. When Pro-Plant is sprayed on the leaves the average increase in yield is about 25%-30%. The percentage drop in costs is usually about 35%. These are common results.

1. Farmers in Chiang Rai Province, Thailand

- While we do not have the data to support this as the farmers growing pineapple and bananas in the North of Thailand do not keep records, but these are the general benefits that they have reported after using Bio-Plant and Pro-Plant to grow pineapple and bananas.

Effect on Pineapple

- The fruit is much sweeter than pineapple grown with chemical fertilizer.
- The pineapples are heavier.
- When you look at the pineapples, there have more eyes (scales) around the fruit.
- The pineapples look fresher and more attractive to eat.
- The pineapples keep longer after harvest.
- There are more suckers so that more pineapple plants can be planted and grown.
- The problems with disease disappear. In the first season the farmers can halve the amount of sprays they use, and in the second crop (second year) they can stop spraying chemical sprays altogether. The reason is that the immune system of the pineapple plants becomes stronger and stronger. Also, when the farmers spray Pro-Plant on the leaves and the fruit, the leaves and fruit get coated with micro-organisms, which protect the plants from disease.
- The cost of growing the pineapples drops significantly. In bio-chemical farming the farmers can halve the amount of chemical fertilizer they use, and if they also prepare the soil with organic matter mixed with Bio-Plant, and spray Pro-Plant over the plants every month (or every 2 weeks for better effects), they get a noticeable increase in yield. Usually the increase in yield, they say, is about 30%. This is standard for bio-chemical farming.
- After 3 years they can sell the pineapples as “100% Organic Pineapples”, and get a higher price.

Effect on Bananas

- The bananas are sweeter than pineapple grown with chemical fertilizer.
- The weight of bananas per tree is higher. Normally, the farmers spray Pro-Plant every month, but they say that the effects are better if they spray Pro-Plant twice or even three times per month.
- The bananas look more attractive to buy and eat as the skin is shinier.
- The bananas don't have black spots on them.
- The bananas keep longer after picking.
- The farmers can sell the banana leaves for wrapping food because the leaves have more cutin and look fresher and shinier.
- The problems with disease disappear. In the first season the farmers can halve the amount of sprays they use, and in the second crop (second year) they can stop spraying chemical sprays altogether. The reason is the same as outlined above with pineapples.
- The costs of growing the bananas drops significantly. As in the case of pineapple, in bio-chemical farming the farmers can halve the amount of chemical fertilizer they use, and if they also

prepare the soil with organic matter mixed with Bio-Plant, and spray Pro-Plant over the banana trees every month (or every 10-14 days for better effects), they will get a noticeable increase in yield.

- The farmers stress the importance and benefit of preparing a lot of compost mixed with Bio-Plant and placing this around the banana trees. In the first year they took the recommendation of making up to 20 MT of compost and organic matter for each hectare, and they reaped the benefits of doing this. In the second year they could reduce the amount of organic matter they use as the soil has become rich in micro-organisms.
- After 3 years they can sell the bananas as “100% Organic Bananas”.

2. Other Field Test Results

Effect on Grass

- The effect on a golf course was that the grass and the soil became softer and the growth was better. The same happens on lawns.

Effect on a Pond Similar to a Golf Course Pond

- We chose a smelly pond in an area of farmland that was full of algae and rotting grass, and into which chemical fertilizer had seeped into. It was in a worse state to what one finds on a golf course in our experience. We applied 2 litres of Bio-Plant to the pond according to the volume of water, which we calculated to be about 200 tonnes, and after about 2 weeks when we went back the pond had become much cleaner. The smell had gone and the water was clearer. The chemicals had been consumed by the micro-organisms in Bio-Plant.
- Bio-Plant contains beneficial micro-organisms that clean polluted ponds. The micro-organisms consume the excess chemicals and nutrients that have come from the chemical fertilizers and pesticides used on the grass. They also break down the decaying vegetation and other organic matter that these nutrients are derived from, while at the same time releasing oxygen back into the pond.
- This introduction of increased oxygen levels creates two positive effects. Increased levels of oxygen in the water will cause the decomposition of organic matter to occur faster, thus limiting the amount of nutrients available and creating clearer water. Increased amounts of oxygen also squeeze out other gases like carbon dioxide and ammonia.

Effect on Tea

- Many farmers in the hills of North Thailand have use the bio-fertilizers to grow tea. After spraying Pro-Plant on Day 1 and Day 8 during a 2-week leaf-picking period they obtain the following standard benefits:
 - The yield is a good 20% higher than with their chemical fertilizer tea, even when they do not prepare the soil with Bio-Plant and only spray Pro-Plant on the leaves. It is standard that the tea bushes produce more leaves and branches.
 - The leaves look fresher and shine more.
 - The tea has less tannin and tastes less bitter.
 - Some farmers use bio-chemical fertilizer (NPK and Urea mixed with 330 cc of Bio-Plant) and spray Pro-Plant on Day 1 and Day 8, while others have stopped using chemical fertilizer and grow tea organically by preparing the soil with organic matter mixed with Bio-Plant and spraying Pro-Plant onto the leaves on Day 1 and Day 8. Comparing their results, the farmers using bio-chemical fertilizer and also spraying Pro-Plant get a slightly higher (5%) yields, but their costs are higher as they are using chemical fertilizer. Over time the difference in the yield disappears as the condition of the soil improves with continuous 100% organic soil preparation.

The Testing Result of Bio-Fertilizer, Bio-Plant99 and Pro-Plant99

As the government by Agriculture and Co-operative ministry has the policy to let the farmers using Bio and Organic fertilizers to replace chemical fertilizers more and also like the farmers to produce Bio and Organic fertilizers by their own but some raw materials are rare to find and some locations could not find the materials to produce Bio or Organic fertilizers. Nowadays, there are some factories producing Bio and Organic fertilizers and someone introduced Bio-Plant 99 & Pro-Plant 99 to test. So I suggest my father in law, Mr. Inpol Tariya to use with outseason Logan during Aug.,2002 to Feb., 2003 with not much confident due to never use Bio-Fertilizer before.

The comment to use Bio-Fertilizer after using Potassium Chlorate 30 days by using Pro-Plant99 200cc. With water 200 Litre mixing with fertilizer 13-0-46 and pesticide, spraying every 10 days, for the soil using Bio-Plant99 with fertilizer 15-15-15 with the ratio 100 cc/ water 200 litre, using normal Lotus bucket to pour at the bottom of the Logan and then water again until 1 month before fruiting picking up.

After using Bio-Plant 99 for one month, the soil condition is in much better, Logan creates more roots faster, so recommending to use Bio-Plant 99 together with Dolomight silica.

By the year of 2002, Logan has more fruits but some Logan plants have yellow leaves, so the roots may have problem with Potassium Chlorate, suggesting Bio-Plant99 to pour repeating using the ratio of 200cc./water 200 Litre, after pouring Bio-Plant99 for 1 month, the yellow leaves disappear and becoming green as usual, the fruits of Logan for this year will be much more than last year, also the fruits are bigger, sweeter. The Logan traders at Lumpoon need to buy the Logan from this farm to export abroad.

So after testing Bio-Plant99 and Pro-Plant 99, we are confident that the result is much better than using chemical fertilizers alone, the production of Logan increases 30%, so we are confident to recommend using Bio-Plant99, Pro-Plant 99 for all the Logan farmers.

With Respect,



Mr. Sompong Samtheunkaew
Agricultural Officer 6
Viengsa Agricultural Office, Nam Province

MEMORANDUM

Govern. Section: Service & Transferring Agriculture Technology Center of Tambol
Namsom

At: TTT, 0809. 01/1
2003

Date 9 June,

Sub: Inform the result of using Products

To: The Manager of Artemis & Angelio Co.,Ltd.

As the promotion group of producing Logan and Lychee in the Planting Promotion Project, under the control of Service & Transferring Agricultural Technology Center at Namsom, bringing Bio-Fertilizer-Bio-Plant99 and Pro-Plant 99 of Artemis & Angelio Co.Ltd. to alert the Logan, Lychee blooming, fruiting to get better weight, sweeter, more crispy and delicious, it is very suitable to better result of Logan & Lychee and to use it reducing chemical fertilizer.

With Respect,



Sirichai Kampukaew
The service & Transferring Agricultural
Technology Center
Director at Namsom District

THE PROJECT OF NON-TOXIN AGRICULTURE AND SUFFICIENT
ECONOMY & ECO-FRIENDLY FARMING

14 Moo11, T. Wangnamkhiew, Nakornrajchaseema 30370
Tel: 044- 249 107, 044-249 109, 01-977 8699

At. . 10/2546

6 Jan.,2003

Subject: To inform the result of using the products
To: The Manager of Artemis & Angelio Co.,Ltd.

As the promotion group of Non-Toxin Agriculture "Wang Namkhiew, the king project of sufficient Economy & Eco-Friendly Farming" bringing the Bio-Fertilizer " Bio-Plant 99 and Pro-Plant 99" of Artemis & Angelio Co.,Ltd. to use with demonstrate vegetable farm of our members, the result shows that the vegetables are well growing, strong, a lot of roots, fast growing frutation, good weight, can resist the plant insects, the most important result is having good weight, sweet, crispy and good taste, it is very suitable for farmers to use Bio-Plant 99 and Pro-Plant 99 instead of chemical fertilizer.

With Respect,

Mr. Amnarj Maiyodkiang
The Chairman of Project Sufficient
Economy & Eco-Friendly Farming

Fruit crop e.g. lychee, longan, orange, pumelo etc.

Fertilizer	Time	Quantity	Water	Crop area	Cost (usd/acre)
microbial liquid fertilizer & bio-liquid fertilizer	accelerate	125 cc	400 litre	1 acre	1.5
	Growth	400 cc	400 litre	1 acre	4.8
microbial liquid fertilizer & bio-liquid fertilizer	before	125 cc	400 litre	1 acre	1.5
	blooming	400 cc	400 litre	1 acre	4.8
microbial liquid fertilizer & bio-liquid fertilizer	fruitation	125 cc	400 litre	1 acre	1.5
		400 cc	400 litre	1 acre	4.8
Total					18.9

Chemical fertilizer	Time	Quantity	Water	Crop area	Cost (Baht/rai)
15 - 15 - 15	accelerate	50 kgs	-	1 acre	9.6
	vegetative growth			1 acre	9.6
15 - 15 - 15	blooming	50 kgs	-	1 acre	9.6
13 - 13 - 21	fruitation	50 kgs	-	1 acre	9.6
Total					38.4

Conclusion

Cost of chemical fertilizer (9.6usd/bag)	38.4 usd/acre
Cost of bio-fertilizer (12 usd/bottle)	
- Microbial liquid fertilizer (12 usd/bottle)	4.5 usd/acre
- Bio-liquid fertilizer (12 usd/bottle)	14.4 usd/acre
Total	<u>18.9 usd/acre</u>
Save	<u>19.5 usd/acre</u>

Analysis of bio-fertilizer cost for 1 acre vegetable crop by micro-springer

Fertilizer application by microspringer

1. preparing plot, mix 100 cc of microbial-liquid fertilizer with 200 litre of water and then pouring into the plot
2. seed dipping, wrap seed with thin cloth and dip in the solution of 5 cc of microbial liquid fertilizer mix with 20 litre of water for 10 – 12 hours, then dry at room temperature and then sow
3. seelling stage, mix 100 cc of bio-liquid fertilizer with 10 litre of water, add into the in pond with 90 litre of water, spray by springer
4. after seedling every 5-7 days, spray the mixture of bio-liquid fertilizer 4-5 times
5. nourish the soil, add the mixture of 25 cc of microbial-liquid fertilizer with 100 litre of water into the plot at least once a month

Cost of microbial liquid fertilizer Bio – Plant 99 per time

1. plot preparation and seed dipping	1.2 usd
2. seedling	1.1 usd
3. after seedling 5 times	5.6 usd
4. nourish the soil	<u>0.56 usd</u>
total	<u><u>8.46 usd</u></u>

Comparing the cost of microbial liquid fertilizer and chemical fertilizer, it is found that microbial liquid fertilizer costs less than chemical fertilizer.

Report On Organic Microbial And Bio – Liquid Fertilizer Trials Conducted In Gombe State By Gombe State Agricultural Development Programme In 2011

Introduction:

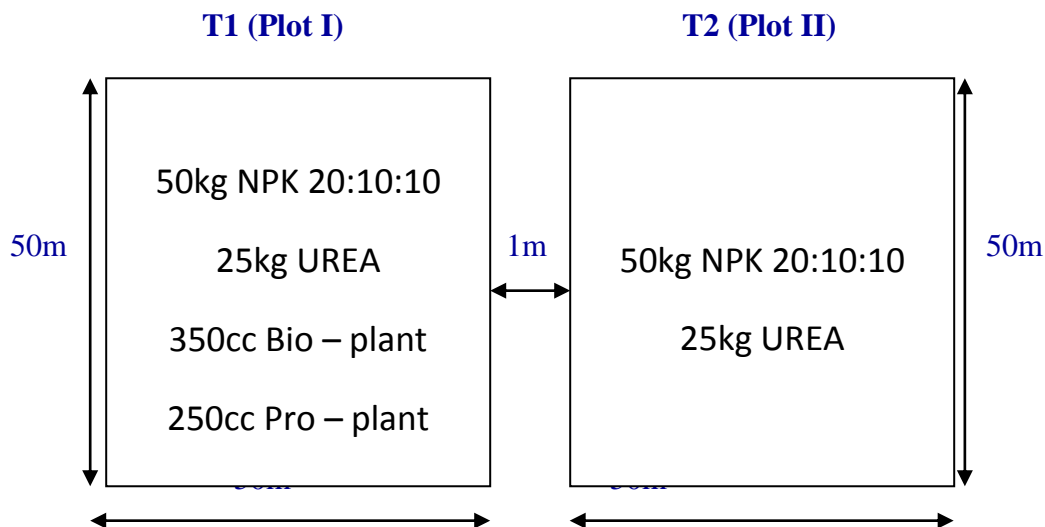
The demonstrations were conducted in two locations Pokata and Posulte in Shongom and Billiri Local Government Areas, the crop demonstrated is maize. The Pokata site has sandy soil, while that of Posulte is clay loam soil. The plots were established behind normal maize planting period in the areas due to late arrival of the products (organic liquid fertilizers). Normal maize planting period in the areas ranges from 15th May to 30th June, while the demonstrations were planted on 11th and 12th June, 2011 respectively.

Details of the demonstrations are as per below

Trial Locations:

S/n.	Name of Farmers	Planting Date	Location	LGA	State
1.	Edwards Amos	11/07/2011	Pokata	Shongom	Gombe
2.	Ambore Fartashi	12/07/2011	Dangor Tal	Billiri	Gombe

Field Layout:



Establishment Processing and performance Details:

The conventional fertilizers (NPK/UREA) were spread on tarpaulin, the liquid organic fertilizer sprinkled on it and mixed together. This was sown in between maize stands. This methods was

employed because of the late establishment of the plots. Pokata application date was 11th August 2011, while that of Dongor Tal was 12th August 2011, both are math after seed planting. After 40 days from the first day of application 20cc/20 litres Knapsack of pro - plant liquid fertilizer were applied three times at 10 days intervals.

These trials at the two different locations showed distinctive differences between plot I and II in terms of plant height, stem size and com ear size. Apart from these, plot one in which the organic liquid was applied along side conventional fertilizer has its cobs (com ear) maturity/drying with the stem and leaves still green, while plot two has shorter plants, smaller cobs with the plant and cob drying at the same time.

Below are some pictures taken from the plots.



THE PROGRAMME MANAGER OF THE ADP AND AN EXTENSION STAFF
DURING A SUPERVISION VISIT OF THE DEMONSTRATION PLOT



THE PROGRAMME MANAGER AND THE SASAKAWA GLOBAL 2000 COORDINATOR STANDING AT THE BORDER OF PLOT I AND II DURING THE FIELD-DAY



A MATURE COB ON PLOT I WITH STEM AND LEAVES STILL GREEN



A PLOT LEVEL ON ONE OF THE DEMONSTRATION PLOT AT POKATA

Farmer Field-day:

A farmer field –day was conducted and attendance was very encouraging with about 56 in attendance. Field-days or farmer’s days are usually large gathering organized as a means of demonstrating farming practices, results of trials and demonstration or new farming equipments or tools.

Among the dignitaries that attended included Local Government Officials, District and Village Heads, Staff of the Ministry of Agriculture and the ADP, Journalists from Gombe State Television and Radio houses. The programme was aired on Radio and Television. Below are some pictures from the field-day scene.



EXTENSION SUPERVISOR ANSWERING FARMERS QUESTIONS DURING THE FIELD-DAY



PARTICIPANTS AT THE FIELD-DAY GOING ROUND THE DEMONSTRATION PLOT
(AT THE BORDER OF PLOT I AND II)



GROUP PHOTOGRAPH OF PARTICIPANTS DURING THE FIELD-DAY

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

Farmers Reaction:

All farmers were highly impressed to the extent that they were requesting and enquiring how they are going to procure the organic liquid fertilizer and where to get it. The two benefitting farmers requested that the same trial be carried out in the year 2012 rainy season for them to learn more on the techniques of using these fertilizers. The farmers commended the effort of the ADP in sitting the demonstrations on their farmers. The remarkable difference between his practice and that of the liquid organic fertilizers has made them to appeal for continue supply of the products. The pro-plant had an insecticidal effect on weevils, grasshoppers, and even aphids has impressed them.

Conclusion:

The product seems to be a manna from heaven for farmers in the state. Despite the fact that this trial was lately established, yet the impact was so apparent. In order to spread the good news across the entire state, we are suggesting that the trial be conducted in all the LGAs of the state using different crops according to major crops of different ecologies of the state.

Product for the proposed 2012 trials be made available quite in time (March - April) so that the Bio - Plant soil treatment process can be adhered to strictly for efficient performance. It could be seen as indicated earlier in this write-up that the two products were just mixed with chemical fertilizer and applied due to time constraint.

Malawi: Provisional Report about the 3 Years of Field Tests

AGMA HOLDINGS LTD
Agma House, Maselema Industrial Area
P O Box 782, Blantyre, Malawi.

TO: Mr. Peter McAlpine, Artemis and Angel Co. Ltd, Bangkok, Thailand
FROM: Wellington CHATEPA, Agribusiness Development Consultant, AGMA Holdings Ltd
Copy: Rt. Hon Katsonga Phiri, Group Chairman, Agma Holdings Ltd
DATE: 26th September, 2012
SUBJECT: REPORT ON BIOFERTILIZER EVALUATION PROJECT IN MALAWI

Dear Peter,

It gives me great pleasure to inform you that we have now come to the end of our evaluation work on Bio Plant and Pro Plant bio-fertilizers in Malawi. This development follows a meeting of the Soil Fertility and Engineering Commodity group of the Department of Agricultural Research Services (DARS) of the Ministry of Agriculture which was held to review the Project among others at Sunbird Livingstonia Beach Hotel in Salima during week beginning 16th September 2012. Performance results of our biofertilizers for the entire 3 years were reviewed and the products were recommended for presentation to the Agricultural Technologies Clearing Committee (ATCC), which is scheduled to meet within the next month or two.

This is a giant leap for the project. I have attached the full report of the project in the annex. What remains now is for Agma Holdings Ltd to embark on an extensive marketing activity for the product in Malawi. This entails advertisements and tours to strategic areas of the country. This will also give us good grounds to sell the credit fund scheme to the government. It is my hope that the ATCC will find no reason to procrastinate the certification of the technology.

Referring to your request for bringing the product to the attention of the State President through one of your "agents (not in Malawi) who has an attorney friend who knows a very close friend of Malawi's President", I am inclined to think twice over the approach. The ATCC is meeting in the foreseeable future, after which we should be able to operate with the full backing of a legal framework. I would not opt to cast our effort and investment to fate. Meanwhile I urge you to supply us with brochures in simple language on the instructions for use by farmers and government extension workers.

Yours sincerely,



Wellington CHATEPA
AGRIBUSINESS DEVELOPMENT CONSULTANT
AGMA TRADING COMPANY LTD

ANNEX
2009-2012 FINAL REPORT

Evaluation of Bio-Plant and Pro-Plant Fertilizers for Soil Fertility Improvement and Maize Grain Yield Production in Malawi

M.W. Munthali and ¹M.M. Soko

Soil Fertility and Plant Nutrition Section and ¹Plant Pathology Section
Bvumbwe Agricultural Research Station, P.O. Box 5748, Limbe,

1.0 Introduction

In Malawi most of the soils are highly weathered, infertile, low in soil organic matter (OM) and soil nutrients. The main reason is because of continuous cultivation of crops on the same piece of land with little inputs added leading to severe nutrient mining. Maida and Chilima (1976) reported that continuous cultivation without inorganic fertilizer and manure application resulted in a marked decrease in total organic matter, nitrogen (N) and exchangeable potassium (K), magnesium (Mg) and calcium (Ca). Soil fertility decline among smallholder farmers is the major factor responsible for the food insecurity in the country (Chilimba et al, 2007). Soil productivity can be improved and maintained through use of organic and inorganic fertilizers. In view of this, use of chemical fertilizers has been advocated for many years to replace the depleted nutrients. However, most smallholder farmers are unable to access inorganic fertilizers due to high cost. Carr (1997) reported that the use of fertilizer by farmers has declined to almost 40% due to increased fertilizer prices.

Other technologies have been developed, tested and promoted to the farmers in an effort to improve soil productivity. However, most of such technologies (e.g. compost manure) are limited in terms of their usage among most farmers. This is basically because the technologies are labour intensive, time consuming and take longer time to mature. Most farmers prefer to burn crop residues during land preparation. As such soil fertility continues to decline and OM matters levels are becoming very low. Other cheap and less labour intensive technologies are required for use among farmers for improvement of soil fertility and crop yield production.

Bio-plant and Pro-plant are microbial bio-fertilizers manufactured by Artemis and Angel Co. Ltd and have been introduced in Malawi by Agma Holdings Ltd. The bio-fertilizers are claimed to have many advantages and can significantly improve soil fertility and crop yield production. The bio-fertilizers are beneficial to the soil and plants. They are able to soften and aerate hard pan soils and make them crumble and increase nutrient availability to the plants. They are able to accelerate plant growth, strengthen plant immune system, greatly increase pest resistance and crops are protected from plant diseases. Bio-plant is claimed to remove about 20% of harmful insects in the ground through breaking of the lifecycle (www.artemisthai.com). The two bio-fertilizers can be used in:

1. Bio-chemical farming:
 - a. Farmers can reduce by 50% the amount of fertilizers and pesticides used in bio-chemical farming. The yield production could be increased by 30% when Bio-Plant is used in seed and soil preparation and Pro-Plant is sprayed on leaves.

2. 100% organic farming:

- a. The crop yield can increase in the range of 15-30% to begin with compared to chemicals and the increase can go up much higher depending on the situation.
- b. The use of Bio-plant and Pro-Plant has the capacity to restore soil fertility of poor soils such as poor sandy soil. Use of bio-compost can quickly change the poor soil into fertile soil in a year.

The test results of bio-fertilizers by farmers and research institutes in different crops have shown to improve soil fertility and increase crop yields. The fertilizers have been tested in such crops as rice, bananas, pineapple, rubber, cotton, maize, tobacco, tea, beans and various vegetables such as carrots. The products have been tested and used in countries such as Thailand, Vietnam (2007- 2009), Azerbaijan (2009), Bangladesh (2008), Benin (2009), China (2008-2008), Indonesia (2009), Kenya (2009), Mauritius (2008), Namibia (2009), Nigeria (2009), and Pakistan (2008-2009). In all the tested countries the crop yields increased from over 20 – 50% depending on the crop and country. In Nigeria, tests on rice at IITA Research Institute in Ibadan have shown that Bio-Plant and Pro-Plant produce a higher quality yield for a lower cost than Urea and NPK. The tests were part of a pre-selection process for tests to be carried out by Bill Gates Foundation, which is choosing a microbial , 100% organic fertilizer for use by the Foundation around Africa. The institute has indicated that it will recommend the bio-fertilizers to the Foundation. In Pakistan during 2008 – 2009, use of bio-fertilizers reduced the costs of cotton production by about 40% than the use of chemical fertilizers. In Benin, the cost of carrot production went down to 35% due to use of biofertilizers. Tobacco field tests in Yunnan province of China showed that there was a 30% - 40% increase in yield in 100% organic farming compared to chemical fertilizers with much lower costs. The leaves were larger, longer and fresher- looking. Field tests in rice in Harbin, north China, showed a 50% increase in yield in 100% organic farming compared to chemical fertilizers with much lower costs. In Mauritius (2008), field tests on green beans indicated that there was a 30% increase in yield in 100% organic farming compared to chemical fertilizers with much lower costs (Artemis and Angel, 2009a).

Although literature review has demonstrated that biofertilizers are promising in the improvement of soil productivity and crop production, their evaluation has not been done in Malawi. At the same if farmers are using these bio-fertilizers in maize production, they are doing so without adequate information such as optimal application rates and their effects on soil fertility. There is no scientific data, generated in Malawi, to support the claims about Bio-Plant and Pro-Plant bio-fertilizers on their performance on soil fertility improvement and crop responses on yield production. The purpose of this work, therefore, is to evaluate the effects of Bio-Plant and Pro-Plant microbial bio-fertilizers on the improvement of soil fertility and maize crop yield production under Malawian field conditions. The generated information will be useful to the farmers in their agricultural production.

2.0 Objectives

- To evaluate the effect of Bio-Plant and Pro-Plant bio-fertilizers on soil fertility improvement
- To evaluate the effect of Bio-Plant and Pro-Plant bio-fertilizers on Maize grain yield production under field conditions
- To determine the optimum application rates for optimum Maize grain yield production

3.0 Materials and Methods

3.1 Nutrient Composition of Bio-Fertilizers

Laboratory analysis results indicated that biofertilizer Bio Plant and Pro Plant contained molasses as a substrate and beneficial fungi that include *Aspergillus*, *Polyporus* and *Rhizopus* and other microorganisms that include *Bacillus*, *Achromobactor*, *Streptomyces*, *Aerobactor*, *Nitrobactor*, *Nitrosomonas*, *Pseudomonas*, and *Clostridium*. The total plate count is 1.5×10^6 CFU/ml. The analysed microorganisms exist in the natural environment. The product contains many nutrients which are also higher as compared to other organic sources of fertilizer. The nutrient composition is given in Table 1 below as analysed by the Benin National Institute for Agricultural Research under the Ministry of Agriculture, Land and Fisheries in the Republic of Benin in 2005. The product is claimed to have no specific associated hazards. More details on the safety of the product are given in Appendix 1. No protective clothing is required when handling the product and there are no negative effects. The product has no environmental hazard as it contains no toxic chemicals (Artemis and Angel, 2009b).

Table 1. Nutrient Composition of the Bio-Fertilizers

No.	Element	Composition Fraction
1	pH	4.9
2	N	4.9 – 5.6%
3	P ₂ O ₅	0.87%
4	K ₂ O	1.01 – 1.14%
5	CaO	2.20 – 2.60%
6	MgO	0.45%
7	S	0.30%
8	Cl	11.1 – 11.3%
9	Zn	33.0 – 34.2%
10	Fe	179.0 – 181.0ppm
11	Cu	Trace
12	Mn	Trace

3.2 Preliminary Greenhouse Pot Experiments

Greenhouse experiments were conducted to obtain preliminary data. The pot experiments were carried out at Bvumbwe Agricultural Research Station. There were 2 soil types: Sterilized and Unsterilized; and 5 different treatments (Table 2) replicated 3 times in randomised complete block design. 3 maize plants were planted in a 5 litre pot of soil.

3.3 Evaluation Field Trials of Bio Plant and Pro Plant

The evaluation field trials were conducted at Bvumbwe and Bembeke under controlled conditions for three years from 2009 to 2012. The two sites have soils differing in soil reaction with values less than pH5.5 at Bembeke and pH 5.6-7.0 at Bvumbwe. The Bio-Plant and Pro-Plant were used either alone or in combination with chemical fertilizers or organic fertilizers. Maize was grown on plot sizes of 5m by 6 ridges spaced at 0.75m. The ridges were 25cm high. The treatments are going were laid as RCBD with 3 replicates. The treatments were laid as RCBD with 3 replicates. The treatments are given below:

a) Organic farming:

1. Zero fertilizer application
2. 92 kg N/ha Compost manure (5000kg/ha)
3. 50cc Bio-Plant plus 50cc Pro-Plant in 70L of water mixed with 500kg organic material (dead leaves/plants, cow dung etc) per ha
4. 150cc Bio-Plant plus 150cc Pro-Plant in 210L of water mixed with 1500kg organic material (dead leaves/plants, cow dung etc) per ha
5. 250cc Bio-Plant plus 250cc Pro-Plant in 350L of water mixed with 2500kg organic material per ha
6. 300cc Bio-Plant plus 300cc Pro-Plant in 420L of water mixed with 3000kg organic material per ha
7. 250cc Bio-Plant plus 250cc Pro-Plant in 350L of water alone per ha

b) Bio-chemical farming:

1. Zero fertilizer application
2. 92 Kg N/ha (200 kg of 23:21:0+4S; 100 kg of Urea) recommended fertilizer rate
3. 330cc Bio-Plant plus 50 Kg (34 kg 23:21:0+4S; 17 kg Urea) fertilizer
4. 660cc Bio-Plant plus 100 kg (67 kg 23:21:0+4S; 33 kg Urea) fertilizer
5. 990cc Bio-Plant plus 150 Kg (100 kg 23:21:0+4S; 50kg Urea) fertilizer
6. 1320cc Bio-Plant plus 200 Kg (134 kg 23:21:0+4S; 67kg Urea) fertilizer
7. 1320cc Bio-Plant alone per ha

3.4 Mixing of Bio-Plant with Chemical Fertilizer

50kg of chemical fertilizer were placed on a plastic sheet of 1.5 x 1.5m² spread out on the ground. Then Bio-Plant was spread on top and the two were evenly mixed. The bio-chemical fertilizer mixture was applied the same day.

3.5 Mixing of Bio-Plant and Pro-Plant with organic material

70 kg of organic matter was spread on top of ridges. Then 5cc Bio-Plant and 5cc Pro-Plant were mixed in 7L of water. The bio-fertilizer was then sprayed on top of the organic material put on the soil. The soil was watered every 7 days while it was under preparation. The Maize was then planted after 14 days of bio-fertilizer treatment to the soil.

3.6 Tracing of bio-fertilizer microbes in the inoculated soil and Maize plants

Soil samples were collected before Bio-Plant and Pro-plant application and after crop harvesting. Data on microbial populations were also collected. Xzapex Agar for soil and Potato Dextrose Agar for plants were used for culturing and identification of microbial populations in the inoculated soil and maize crops.

3.7 Data Collection and Analysis

The following data parameters were collected: Rainfall; Temperature; Soil physical parameters (water retention, texture, structure, bulk density, hydraulic conductivity); Soil Chemical parameters (pH, CEC, AEC, OM, N, P, K, S etc); Pest and Disease scores; and Maize Grain yields. Identification of micro-organisms (bacteria, fungi) was also done using specific culturing media. All collected data was subjected to statistical analysis at 95% level of confidence by a scientific software called GENSTAT.

4.0 Results and Discussion

4.1 Greenhouse Experiments

The biomass yield data is given in Table 2 and 3 below. Results in Table 2 and 3 clearly indicate that there were significant ($P \leq 0.001$) biomass yield differences among the treatments and between the soil types. Harvested maize biomass significantly ($P \leq 0.001$) increased from 23 to 84% over the control. The percentage biomass increase over the control was more in the unsterilized compost and soil (35-84%) than sterilized compost and soil (23-43%). The results suggest that Bio Plant and Pro Plant biofertilizers enhance the release and availability of plant nutrients through mineralization of OM and fixation of N from the atmosphere. The results also imply that Bio Plant and Pro Plant are effective sources of fertilizer for maize production. The higher biomass yield in sterilized soil was due to competition for nutrients by soil micro-organisms and weeds, which was higher in unsterilized soil.

Table 2. Effect of Bio-Plant and Pro Plant on Maize Biomass Yield (g/pot) in a pot experiment

Treatment	Maize Dry Biomass (g/pot)		Mean
	Sterilized Soil	Unsterilized Soil	
Control	11.68	3.18	7.43
Bio Plant/ Pro Plant	15.33	4.91	10.12
Bio Plant/ Pro Plant + Chemical fertilizer	16.67	10.09	13.38
Bio Plant/ Pro Plant + Compost manure	23.00	20.11	21.56
Compost Manure	20.67	20.17	20.42
Means	17.47	11.69	
%CV: 22.5			
LSD_{0.05} : Soil Type = 2.519; Treatment = 3.983			

Table 3. Effect of Bio-Plant and Pro Plant on Percentage Maize Biomass Increase over Control

Treatment	%Maize Dry Increase over Control		Mean
	Sterilized Soil	Unsterilized Soil	
Control	0	0	0
Bio Plant/ Pro Plant	23.81	35.23	29.52
Bio Plant/ Pro Plant + Chemical fertilizer	29.93	68.48	49.21
Bio Plant/ Pro Plant + Compost manure	49.22	84.19	66.70
Compost Manure	43.49	84.23	63.86
Means	36.61	68.03	

4.2 Field Evaluation Trials

4.2.1 Soil Test Results

The soil field test results of Bio Plant and Pro Plant for 2010-2012 seasons are given in Tables 4 and 5. Results for Bembeke were still being analyzed at the time of compiling this report and will be included in this report when finalized. The results indicate that there were significant differences ($P \geq 0.5$) between bio-organic and bio-chemical farming during the 2010/11 and 2011/12 seasons. The means of pH, OM, and N were higher in bio-organic than in bio-chemical, while for P it was higher in bio-chemical than in bio-organic treatments. Generally the values were higher in treatments containing Bio Plant and Pro Plant than the control. For example during the 2010-11 (Table 5), under bio-organic farming P levels were 11.89 $\mu\text{g/g}$ higher than treatments 1 and 2 where the values were 9.44 $\mu\text{g/g}$ and 9.0 $\mu\text{g/g}$ respectively translating into over 30% increase in soil P. The results suggest that Bio Plant and Pro Plant enhanced availability of nutrients to the maize plant.

Table 4. Effect of Bio Plant and Pro Plant on Soil Parameters at Bvumbwe during 2010-11 season

Treatments	Soil pH		% Soil OM		% Soil N		Soil P ($\mu\text{g/g}$)	
	Bio-Organic	Bio-Chem.	Bio-Organic	Bio-Chem.	Bio-Organic	Bio-Chem.	Bio-Organic	Bio-Chem.
1	5.93	5.75	1.29	0.697	0.063	0.033	5.67	15.67
2	5.72	5.88	1.20	0.933	0.060	0.047	6.00	15.33
3	5.87	5.67	1.33	0.66	0.067	0.033	6.00	11.00
4	5.79	5.69	1.27	0.997	0.063	0.050	6.67	12.00
5	5.74	5.69	1.35	1.26	0.067	0.060	7.33	6.67
6	6.02	5.64	1.44	0.84	0.073	0.040	6.00	12.33
7	5.79	5.66	1.63	1.07	0.083	0.053	9.33	16.33
Means	5.81	5.74	1.358	0.922	0.068	0.045	6.71	12.76
%CV	3.9		23.4		24.7		57.2	
LSD_{0.05} Bio-type	0.1447		0.1693		0.0088		3.534	

Table 5. Effect of Bio Plant and Pro Plant on Soil Parameters at Bvumbwe during 2011-12 season

Treatments	Soil pH	% Soil OM		% Soil N		Soil P ($\mu\text{g/g}$)	
	Bio-Chem.	Bio-Organic	Bio-Chem.	Bio-Organic	Bio-Chem.	Bio-Organic	Bio-Chem.
1	4.910	1.49	1.58	0.074	0.079	9.44	8.33
2	4.463	1.34	1.57	0.067	0.078	9.00	9.33
3	4.693	1.43	1.49	0.071	0.073	8.11	7.33
4	4.469	1.51	1.45	0.074	0.073	11.89	8.33
5	4.609	1.44	1.42	0.072	0.079	12.67	10.44
6	4.581	1.51	1.57	0.078	0.077	11.00	10.43
7	4.821	1.52	1.54	0.076	0.076	9.11	9.89
Means	4.650	1.46	1.52	0.073	0.076	10.17	9.16
%CV	4.8	19.02		17.08		27.2	
LSD_{0.05}	0.2123	NS		NS		Trt=1.735	

4.2.2 Maize Grain Yield Results

Results on the effect of bio-organic and bio-chemical farming on maize yields for the 3 years at Bvumbwe and Bembeke are presented in Tables 6 to 11. The visual maize crop performance results are shown in Plate 1. The results indicate that there were significant ($P=0.05$) yield differences among the treatments and between the farming types at both Bembeke and Bvumbwe in all the three cropping seasons of 2009 to 2012. The grain yields were higher in all the treatments above the control at both sites Bembeke and Bvumbwe. For example, in 2011 the combined use of 30% chemical fertilizer and 660cc of Pro Plant (**Treatment 6**) gave the highest maize grain yields of 5514 kg/ha at Bvumbwe and 4883 kg/ha at Bembeke. In bio-organic farming, **Treatment 6** gave the highest grain yields at Bvumbwe (3518 kg/ha) and Bembeke (3667 kg/ha). However in 2011/12 cropping season, the grain yields (Table 10) were lower compared to previous years. This could be attributed to erratic rainfall patterns. During the season there were intermittent prolonged dry spells which affected the growth and production of maize plants including grain yields. The dry spells occurred at crucial stages of crop physiological development over a period of three weeks after the three-leaf stage. This compounded with low pH conditions affected the production of grain during the season.

The significant differences in grain yields were due to the effects of the Bio Plant and Pro Plant present in the treatments. At Bembeke yields improved significantly due to the mineralization effect on crop residues by Bio Plant and Pro Plant which also had a liming effect. This means that the Bio Plant and Pro Plant microbes mineralized and fixed more soil and atmospheric N respectively and made them available to the crops for uptake. The biofertilizers further enhanced the availability of soil macro (such as P and K) and micro (such as Mg, Zn etc) nutrients, their uptake and use efficiency by the maize plants as compared to **Treatment 2** where 300 kg/ha of chemical fertilizer alone were applied and got lower yields at Bvumbwe. This suggests that **Treatment 5** was more effective at producing the highest maize grain yields as compared to the rest of the treatments.

The results also indicate that Bio Plant and Pro Plant fertilizer treatments performed much better than the current recommended chemical fertilizer regimes for maize at both sites. The increase over the recommended rate of chemical fertilizers was within the range of 10% and 40% while the increase above the control was between 60% and 90% depending on the site and application rates of the biofertilizers. For example at Bvumbwe, during the 2009/10 season (Table 5), there was a 28% increase in grain yield in **Treatment 3** compared to **Treatment 2**, which carried the recommended rate of chemical fertilizers. This translated to up to 87% grain yield increase over the zero application control plot. Similar trends were observed in the other years at both sites.

The difference in grain yield results between the two sites is ascribed mostly to soil fertility problems. Bembeke had strong acidic soils while soils at Bvumbwe had moderate acidity and this affected the availability of nutrients to crops on one hand and impeded the response of applied Bio Plant and Pro Plant microbes on the other. These results suggest that soil conditions, especially the pH, to some extent affect the performance of the biofertilizers during the initial seasons of application. However plots treated with Bio Plant and Pro Plant positively improved soil fertility, plant nutrition and maize grain production as compared with zero and other treatments at both sites.

Plate 1. Visual effects of Bio Plant and Pro Plant on maize crop at Bvumbwe during 2011-12 season.



Trt 1 – Control: No fertilizer applied



Trt 3 - ½ Rate Bio Plant + Pro Plant + Manure



Trt 2 – Full Rate of Chemical Fertilizers only



Trt 6 - Bio Plant + Pro Plant + ½ Rate Chemical Ferts

Table 6: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bvumbwe during the 2009/2010 Season.

Treatments	Bio-Organic	Bio-Chemical	Means
1	1449	1641	1545
2	3499	3029	3264
3	4473	2376	3425
4	3476	2896	3186
5	4206	2997	3601
6	3827	3792	3809
7	2732	2458	2595
Means	3380	2741	
%CV:	39.03		
LSD_{0.05}	Bio-farming type: 762.4; Treatment 1426.4; Bio-Type* Trt: 2017.2		

Table 7: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bvumbwe during the 2010/2011 Season.

Treatments	Bio-Organic	Bio-Chemical	Means
1	1786	2140	1963
2	2892	4978	3935
3	2487	4342	3415
4	2768	5436	4102
5	2691	5514	4102
6	3518	5345	4432
7	3534	2969	3251
Means	2811	4389	
%CV:	19.4		
LSD Bio-type:	442.8; LSD Trt: 828.5; LSD Bio-type*Trt: 1171.6		

Table 8: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bembeke during the 2011/2012 Season.

Treatments	Bio-Organic	Bio-Chemical	Means
1	3282	2365	2823
2	5570	5101	5335
3	3469	4731	4100
4	3666	5404	4535
5	3134	4444	3789
6	4598	5761	5180
7	3826	4061	3943
Means	3935	4553	
%CV:	29.7		
LSD Trt:	1498.1		

Table 9: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bembeke during the 2009/10 Season.

Treatments	Maize Grain Yield (Kg/ha)		Mean
	Bio-chemical farming	Bio-organic farming	
1	1947	1470	1708
2	2706	1062	1884
3	3064	1819	2442
4	2223	1977	2100
5	2352	3236	2794
6	2183	2914	2548
7	962	1617	1290
Means	2206	2013	
CV (%)	34.3		
LSD_{0.05}	Bio-farming type: 459.3 ; Treatment: 859.2 ; Bio-farming type*Trt: 1215		

Table 10: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bembeke during the 2010/2011 Season.

Treatments	Bio-Organic	Bio-Chemical	Means
1	783	917	850
2	4017	4000	4008
3	2650	3833	3242
4	2533	4017	3275
5	2833	4883	3858
6	3667	3500	3583
7	1300	2333	1817
Means	2540	3355	
%CV: 26.6			
LSD Bio-type: 498.1; LSD Trt: 931.1			

Table 11: Effects of Bio Plant and Pro Plant on Maize Grain Yields at Bembeke during the 2011/2012 Season.

Treatments	Bio-Organic	Bio-Chemical	Means
1	815	917	850
2	1130	4000	4008
3	2426	3833	3242
4	1778	4017	3275
5	1500	4883	3858
6	2481	3500	3583
7	778	2333	1817
Means	1558	3355	
%CV: 35.2; LSD Trt: 656.7			

5.00 Conclusion and Recommendations

- Bio Plant and Pro Plant biofertilizers significantly improved soil fertility and available soil nutrients such as N, P, K etc.
- Bio Plant and Pro Plant biofertilizers significantly increased maize grain yields and were equally effective as chemical fertilizers.
- The rate of 300cc Bio Plant plus 300cc Pro Plant in 420 litres of water mixed with 3000 kg organic material per hectare in bio-organic farming and the rate of 990cc Bio Plant plus 150 kg (100 kg 23:21:0+4S; 50 kg Urea) fertilizer gave the optimum maize grain yield production at Bembeke.
- The rate of 660cc Bio Plant plus 100 kg (67 kg 23:21:0+4S; 33 kg Urea) fertilizer in Bio-chemical farming and rate of 300cc Bio Plant plus 300cc Pro Plant in 420 litres of water mixed with 3000 kg organic material per ha in bio-organic farming gave the optimum maize grain yield production at Bvumbwe.
- The technology is hereby proposed for presentation to the nearest meeting of the Agricultural Technologies Clearing Committee (ATCC) for release.

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Vietnamese Agricultural Association

To: The Tambol Agricultural Association Committees & The Tambol Agricultural Co-Operative Stones Committees

In the production season starting at the beginning of 2004 all the farmers in District Juengmee were highly successful in increasing production compared to the previous production season. It showed that the farmers were trying hard to increase their production. The Association of Co-operative Stores instructed all the farmers in District Juengmee about bio-fertilizer technology and about how to use the bio-fertilizers to grow various kinds of crops, such as rice, beans, tea, lychees, and vegetables.

At the Agricultural Association's seminar on 4th June 2004, the representatives of the Association concluded that after using the bio-fertilizer the crops were stronger and healthier, the seeds were tighter and heavier (loose rice was reduced to +5%), the total production had a better colour, there had been no need to use pesticides, the rice production increased by 24.5 %, Soya Bean production increased by 10%, expenses were reduced by 33.3%, and the increased revenue was 2-4.5 million Dong/hectare (US\$126,662 – US\$284,990).

The Process of Using Bio-Plant and Pro-Plant in the Rice Fields

1. 300 kgs. of organic fertilizer + phosphorus (10 kgs.) were ploughed into the field. After ploughing, Bio-Plant (20 ml.) + water (40 litres) were sprayed over the soil surface 3-5 days after preparing the soil with the organic fertilizer and phosphorus.
2. Put fertilizer on the soil 15-20 days after ploughing.
 - Put urea 2 kgs. On the soil.
 - 3 days after that, mix Bio-Plant (5 ml.) + Pro-Plant (10 ml.) + water (20 litres) and spray it on the rice plants.
 - 30 days after ploughing the rice will produce rice seeds.
 - Then apply 1 kg. of urea + 1 kg. of potassium.
 - 3 days after applying the chemical fertilizer, mix Bio-Plant (5 ml.) + Pro-Plant (20 ml.) + water (20 litres) and spray it all over the rice leaves.
3. While the rice is producing seeds:
 - 40-45 days after ploughing and planting the rice seeds in the soil, the rice will produce seeds.
 - Mix and spray Bio-Plant (5 ml.) + Pro-Plant (20 ml.) + water (20 litres) all over the rice crop and leaves.
4. When the seeds appear:
 - Mix and spray Bio-Plant (5 ml.) + Pro-Plant (20 ml.) + water (20 litres) all over the rice crop and leaves.
5. While the rice seeds are becoming hard:
 - Mix and spray Bio-Plant (5 ml.) + Pro-Plant (20 ml.) + water (20 litres) all over rice crop and leaves

Chieugmee Agricultural Committee Representative
Mr. Fum Suaug Tern

The Results Of Using The Bio-Fertilizers With Rice And Beans In Spring 2004

On 3rd March 2004 the District Association Committee of District Shieugmee, Hartai Province, conducted a seminar to discuss the test results on rice in each district of this District. Because the results had been so positive, at the end of March 2004 the Agricultural Association of District Shieugmee, Hartai Province, received a request from the Provincial Agricultural Association to conduct field tests using the bio-fertilizers, Bio-Plant and Pro-Plant, with several kinds of crops and vegetables during Spring 2004.

First Tests

- Tested on Rice: 6.25 Rai in Meeruaug and Tohdao districts.
- Tested on Soya Beans: 6.25 Rai in Jeugphu district.
- Tested on Green Tea: 7.95 Rai in Jauphu district.
- Tested on Lychees: 100 trees in Hvewan and Waugwhaytho districts.
- Tested on Daoruang Flowers: 5.3 Rai in Ngorbserug district.
- Tested on Cucumbers: 1 Rai in Daieau district.

Test Results 1: Rice

In spite of not being able to prepare the poor soil properly, after 3 months of testing on rice the production of rice had increased by 12% and 20%, depending on the variety. The rice was of a higher quality, healthier and stronger. No pesticides had been used. Costs were reduced by 34% compared to rice cultivation with chemical fertilizers. The revenue of the farmers was far higher than they had ever achieved before.

1.1 Soil Condition: The soil was sandy soil, close to the River Bui. Rubbish had been used before as organic fertilizer. The soil did not hold water well. There were few minerals in the soil.

1.2 Test Areas: Two farming families were chosen to test rice cultivation with the bio-fertilizers. The sizes of their pieces of land were 1.125 Rai and 0.9 Rai. Their land was called the Test Area. On another piece of land, 0.225 Rai in size, chemical fertilizers were used, namely Urea (7 kgs.) and Potassium (6 kgs.), This land was called the Comparison Area. Both test areas prepared the soil first by applying mixed fertilizer (300 kgs.) + phosphorus (10 kgs.) from a local fertilizer factory. The test started on 3rd March 2004 and finished on 15th May 2004, with harvesting on 5th June, 2004.

1.3 Results of the Tests

A. By Size and Quantity

Variety of Rice	Areas	Height (cms.)	Rice Flowers / m ²	Seed Flour	Weight /1000 Seeds	Production (kgs./ 360 m ²)
Q5	Comparison Area	98	270	99.8	24	200.6
	Test Area	99	270	109.3	24.4	224.6
Sticky Rice 352	Comparison Area	98	270	90.4	23.2	195.8
	Test Area	99	300	102.4	24	243.8

B. Test Results after Harvesting

- Q5 (kgs./360m²)
 - Comparison Area 200.6 kgs.
 - Test Area 224.6 kgs.
 - Increasing in Production 24 kgs. (12%)
- Sticky Rice 352 (kgs./360m²)
 - Comparison Area: 195.8 kgs.
 - Test Area: 243.8 kgs.
 - Increase: 48 kgs. (19.7%)

C. Cost Comparison

- Comparison Area
 - Urea 7 kgs.: 3,600,000 (Dong/kg.) = 25,200,000 Dong.
 - Potassium 0.6 kgs.: 3,100,000 (Dong/kg.) = 18,600,000 Dong
 - Pesticide: = 7,000,000 Dong
 - Labor Cost: = 14,000,000 Dong
 - Total Cost = 64,800,000 Dong**
- Test Area
 - Bio-Plantv21 ml.
 - Pro-Plant 84 ml.
 - Labor Cost: = 14,000,000 Dong
 - Total Cost = 43,000,000 Dong**

Saving = 21,800,000 Dong (34%) US\$1 = 15,790 Dong

1.4 Method

- The bio-fertilizers were sprayed 7 times. Each time 2 full tanks were sprayed over an area of 360 m² using Bio-Plant (3 ml.) + Pro-Plant (12 ml.) mixed with 16 litres of water each time.
- When one compares the Test Area and the Comparison Area (both 360 m²), one sees that the farmers saved 21,000,000 Dong, while they increased their income by 2 million to 4.5 million Dong / hectare.

Test Results 2: Beans

2.1 The Test Area

- High sloping land with few minerals in the soil. The depth of the soil suitable for planting was 18.3 cm. from the surface as below that there were big stones. The soil did not hold water. The type of bean used was MD7.

2.2 Procedure

- 10 farming families were chosen, who had connecting farm land, and one family with 300 m² of land was chosen as the Comparison Area.
- The Test Area used organic fertilizer and the bio-fertilizers.
- The Comparison Area used mixed fertilizer (200 kgs.) + phosphorus (20 kgs.) + white silicate (20 kgs.) + urea (3 kgs.) + potassium (5 kgs.).
- The test period was from 10th March 2004 until 24th April 2004.

2.3 The Test Results

A. By Measuring and Counting

Plant Process	Height (cm.)	Roots/Seeds (m ²)	Seeds (qty/m ²)	Bean seeds (inside/m ²)	Weight (100 seeds/gr.)	Production (kgs./360m ²)
Comparison Area	48	442	264	528	38	107
Test Area	46	440	286	572	38	117

B. Results of Harvest (Area of 360 m²)

- The Comparison Area produced 107 kgs.
- The Test Area produced 117 kgs. (+9%)

C. Comparison of Costs

- Comparison Area: 85,000,000 Dong + labor 50,000,000 Dong = 135,000,000 Dong / 360 m² .
- Test Area: Mixed fertilizer 200 kgs. = 30,000,000 Dong + Bio-fertilizers 125 ml. + labor 40,000,000 Dong = 105,000,000 Dong/360 m²
- When one compares the Test Area and the Comparison Area (both 360 m²) one can see that the farmers reduced their expenses by 30,000,000 Dong (29%), and increased their income by 63,000,000 Dong from the increase in crop productivity.
- The beans produced revenue of 93,000,000 Dong, which equals 2.5 million Dong per hectare, which was a significant increase over what the farmers were used to producing.

2.4 Summary

- The tests showed that when using the bio-fertilizers the rice had a stronger core; tighter seeds; improved rice color; there was only 5% loose rice; the rice was a little taller; and the rice flour was long (as stated in the table).
- The soil in the Test Area was not prepared properly in advance because the rice farmers had already started to plough and plant the rice in the fields. Also, when planting Soya Beans (soya beans) the farmers did not prepare the soil with white silicate + phosphorus + the bio-fertilizers. This meant that less bio-fertilizer was applied to the soil than there should have been, so the number of times the rice plants were sprayed was increased. Also, the soil was in poor condition - grade 5 and 6 (low quality) – and there was no chance to extend the growing period.

In spite of these problems, after harvesting, the crops grown with the bio-fertilizers increased their productivity by 12% - 20%, and the farmers reduced their expenses by about 34%, while increasing their income from 2 million Dong to 4.5 million Dong / hectare / season.

- There was no need to use chemicals to protect the crops against pests. The overall production was much better, especially of Lychees, and the taste was noticeably sweeter after using the bio-fertilizers.
- Using Bio-Plant and Pro-Plant increased the quality of the rice, reduced the production costs, and reduced all the normal crop growth problems. There was no need to use the usual harmful pesticides.

The Agricultural Committee Representative of
District Shieugmee
Mr. Fum Suaug Tern
12nd June 2004

Test Results 3: Tea

1. General Conditions

- On 9th June 2004 Bio-Plant and Pro-Plant were used to grow tea plants, and the effects were analyzed on 16th June 2004.
- The tea variety used was a local variety and was grown from seed. It had been planted in the area since 1984. The soil had received very little fertilizer over this time.
- The soil condition was sandy soil mixed with stone. The height of the tea plant was 18 cm. The circumference of the tea leaves was 64.3 cm.
- At the end of 2003 no fertilizer had been applied to the soil.

2. The Test Process

- One farmer family was selected. The planting area was 1,800 m².
- The formula for using the bio-fertilizers was as follows:
 - A. Bio-Plant (5 ml.) + water (20 litres).
 - B. Bio-Plant (5 ml.) + Pro-Plant (10 ml.) + water (20 litres).
 - C. Bio-Plant (5 ml.) + Pro-Plant (20 ml.) + water (20 litres).
- The Comparison Area did not use the bio-fertilizers.

3. The Test Results

Formula	Length of Tea Leaves (Cms.)	Weight of 100 Leaves (Grams)	Quantity Of Leaves (Per M ²)	Produce (Grams Per M ²)	Weight Comparison (Grams)
Test Area Formula A	6.5	95	196	1.86	0.46
Test Area Formula B	7.1	100	232	2.32	0.92
Test Area Formula C	8.2	110	249	2.73	1.33
Comparison Area	5.4	80	116	1.40	-

4. Comments

- Using the bio-fertilizers, the growth rate was clearly faster and the tea leaves were thicker, longer, and greener.
- After using the bio-fertilizers for 7 days, tea-end leaves could be picked, but in the Comparison Area it took 15 days before this could be done.
- The cost of applying the bio-fertilizer was 7,000,000-10,000,000 Dong/360 m², and the production increased by 3-4 kgs. dry weight compared to the Comparison Area, and this added significant extra revenue for the farmers of 75,000,000 – 100,000,000 Dong.

**Hartai Provincial Agricultural Association,
District Juengmee**

Test Results 4: Chili Plants

The Use of Bio-Plant and Pro-Plant with Chili Plants at Eautrack Village, Tambol Kwaugjao, District Kwaugsuaug, Tauwha Province.

The tests with the bio-fertilizers started on 26th May 2004. The bio-fertilizers were sprayed once as follows: Bio-Plant (8ml.) + Pro-Plant (30 ml.) + water (20 litres) on an area of 500 m². After applying the bio-fertilizers 5 times, the results were as follows:

- The chili plants that were grown with the bio-fertilizers had more fruit and flowers (about 140-200 seeds per chili plant) compared to the chili plants in the Comparison Area, which had 100-160 seeds per chili. Plant.
- The chili plants in the soil where the bio-fertilizers were used absorbed water better than the chili plants in the Comparison Area.
- The chili plants in the Test Area (500 m²) produced 300 kgs. of chilis in the area of 500 m² while in the Comparison Area (also 500 m²) only 220 kgs..
- The quality of the chilis in the Test Area lasted longer and had a fresher colour than the chilis in the Comparison Area.

The soil was sandy soil near the sea, and the test results were as follows;

A. Quantity of Bio-fertilizers Used

Times Sprayed	Period of Use	Trial on 500 m ² area			Remarks
		Bio-Plant (ml)	Pro-Plant (ml)	Total (ml)	
1st Time	26/5/2004	8	30	38	
2nd Time	1/6/2004	8	30	38	
3rd Time	6/6/2004	8	30	38	
4th Time	11/6/2004	8	30	38	
5th Time	16/6/2004	8	30	38	
	Total	40	150	190	

B. Comparison of Costs in the Test Area and Comparison Area (500 m²)

Item	Content	Comparison Area			Trial Area		
		Qty	Price/Unit(Dong)	Total(Dong)	Qty	Price/Unit	Total(Dong)
1	Seeds cost			50,000			50,000
2	Animal fertilizer	200 kg	100	20,000	20 kg.	100	20,000
3	NPK	60 kg	1300	78,000			
4	Bio-Plant				40 c.c.	278	11,120
5	Pro-Plant				150 c.c.	278	41,700
	Total			148,000			123,000

Comparison of the Results

1. Comparison Area

- Produced 220 kgs at a selling price of 30,000 Dong / kg. = 660,000,000 Dong / 500 m².
- Revenue minus expenses: 660,000,000 - 148,000,000 = **452,000,000 Dong** profit.

2. Test Area

- Produced 300 kgs. At a selling price of 30,000 Dong / kg. = 900,000,000 Dong / 500 m².
- Revenue minus expenses: 900,000,000 - 123,000,000 = **777,000,000 Dong** profit.

The profit for the farmers who used the bio-fertilizers was 58% higher.

Tester 1: Mr. Dowh Duek Kan
Tester 2: Professor Waugh Bui Dough
30th November 2004

Test Results 5: Vegetables

The Use of Bio-Plant and Pro-Plant with Vegetables at Tambol WaughTauh, District Waughsueug, Tauhwah Province, 28th June 2004

3 kinds of vegetables were tested: sweet lettuce, scented lettuce, and green lettuce.
The growing area was 500 m².

The vegetables in the Comparison Area used the old system by Potassium (10 kgs.), Urea (20 kgs.), and Phosphorus (20 kgs.).

The Test Area used the bio-fertilizers as follows:

Times Sprayed	Period of Use	Testing on 500 m2 area			Remarks
		Bio-Plant(cc.)	Pro-Plant(cc)	Total	
1 time	Soil Adjusted	60	-	60	
2 time	After 10 days	8	30	38	
3 time	After 15 days	8	30	38	
4 time	After 20 days	8	30	38	
5 time	After 25 days	8	30	38	
6 time	After 30 days	8	30	38	
	Total	100	150	250	

The test period was from 24th May 2004 to 24th June 2004. Each vegetable was grown on an area of 500 m². The weather in Tauhwah was hot at 38 C. with south-west winds and heavy rain, which affected the growth of the vegetables significantly.

On 13th June 2004 the rain was heavy and the growing area had no roof cover. The result was that the vegetables in the Comparison Area all died so it was very difficult to make a comparison, but nevertheless there were some points to compare, as follows:

- While the vegetables were blooming, those grown with the bio-fertilizers bloomed 10% more than those in the Comparison Area.
- The vegetables grown with the bio fertilizers were more resistant to the bad weather conditions. By 13th June 2004 nearly all the vegetables in the Comparison Area had died, but much fewer had died in the Test Area. After 2 days the vegetables in the Test Area were recovering and started to look fresh again, and certainly looked much fresher than in the Comparison Area.
- The Test Area vegetables were more resistant to pesticides and had no dark spots on the leaves and roots.
- The taste of the vegetables grown with the bio-fertilizers was better, and the vegetables were crispier than those in the Comparison Area.

Limitation Point

Spraying the bio-fertilizers on an area the size of 500 m² took 1 hour, but using chemicals diluted with water took only 30 minutes.

Summary

The vegetables grown with the bio-fertilizers were more resistant to the weather; they did not need any pesticides; and they tasted better.

In spite of the limited test period, and the adverse growing conditions, the Agricultural Co-Operative Stores of Tambol Waughtauh was impressed with the results and decided to use Bio-Plant and Pro-Plant next season.

Consultant/Expert
Mr. Farmh Suaug Tauh

Evaluator
Mr. Wiaugh Soon Jao
Head of the Agricultural Co-operative Store
Tambol Waughtauh

Test Results 6: Non-Toxic Vegetables Grown Out of Season

For Non-Toxic Vegetables, Grown Out of Season At Tambol Waughjin , District Waughwah, Tauwah Province.

The Test Area was the farm of Mr. Hah Wan Kee, Jingar Village, Tambol Waughjin, District Waughwah, Tauwah Province. The testing started on 18th July 2004 and continued until 27th August 2004. The process of planting seeds started on 18th July 2004.

A. Test Procedure

- 4 types of vegetables were grown out of season, i.e. scented lettuce, Chinese lettuce, nun (a Vietnamese vegetable) and Theelar (a Vietnamese vegetable). They all have a growing cycle of 30-40 days.
- The area of land was 500 m².
- There was a slanted cloth roof to protect the crops from the sun and rain.

The test steps were as follows:

- Organic fertilizer was created by mixing fermented fertilizer (400 kgs.) + NPK fertilizer (8-10-5-13) (10 kgs.)+ Bio-Plant (60 ml.). This was applied to the soil and left to ferment for 5 days to adjust the soil condition before seeding for 2 days.

Time of spraying	Period of use	Test area 500 m2			Remarks;
		Bio-Plant(cc)	Pro-Plant(cc)	Total(cc)	
1 time	12 days after seeding	3	10	13	
2 time	19 days after seeding	5	20	25	
3 time	26 days after seeding	8	30	38	
4 time	31 days after seeding	8	30	38	
	Total	24	90	114	

B. Expenses

Item	Contents	Unit	QTY	Price/unit(Dong)	Total Dong
1	Fertilizer				
	Fermented fertilizer	kg.	400	100	40,000
	NPKS fertilizer	kg.	10	1600	16,000
	Bio-Plant/Pro-Plant	c.c.	214	278	59,000
					Total = 115000
2	Expenses for sun roof				
	Slant	m ²	500	1,400	700,000
	Support post 2.5 m.	pcs	42	5,000	210,000
	Wire	kg.	20	11,000	220,000
	Labour	wage	6	20,000	120,000
					Total = 1250000
3	Seed cost				100,000
4	Labour cost	wage	20	20,000	400,000
	Total				1,865,000

C. Profit

- Vegetables (Market price at that time)
- Scented lettuce (350 m²) 450 kgs. (4,500 Dong/kg.) = 2,025,000 Dong
- Theera (75 m²) 50 kgs. (10,000 Dong/kg.) = 500,000 Dong
- Nun (25 m²) 15 kgs. (20,000 Dong/kg.) = 300,000 Dong
- Chinese lettuce (50 m²) 10 kgs. (20,000 Dong/kg.) = 200,000 Dong
- The 4 crops earned 3,025,000 Dong.
- Profit after expenses 3,025,000 – 1,865,000 = 1,160,000 Dong

During the 40 days from seeding to the harvested crop, deducting all the expenses, the result was a profit of 1,160,000 Dong, even with the slanted roof included as part of the expenses. This expense would not be included in the future.

Summary about the Test Area Vegetables

- The soil was looser and not rusty after rain (In the area which did not have a roof and used chemical fertilizer there was thick rust, which made the crops grow less well.
- The vegetables that were grown with the bio-fertilizers did not need pesticides, unlike the crops grown in the Comparison area.

Reported by Agricultural Tambol Waughjin

Date: 27th August 2004

Tester: Mr.Hah Wan Kee

Test Results 7: Mulberry

The Use of Bio-Plant and Pro-Plant on Mulberry at Tambol Teaohdo, District Teaohwah, Tauwah Province 27th July 2004

1. Mulberry

Test Area: 10 villages in Tambol Teaohdo, District Teaohdo, Tauwah Province.

1. Test Type I: Using Fertilizer While The Mulberry Is Growing

Size of Test Areas

- The Test Area using the bio-fertilizers was 2,000,000 m².
- The Comparison Area was 500 m².

Cost of Fertilizer

- The Comparison Area used urea (20 kgs.) costing 4,000,000 Dong/kg. = 80,000,000 Dong.
- The Test Area used the bio-fertilizers (Bio-Plant + Pro-Plant) 4 times. Each time 38 cc. was used at a cost of 278 Dong/cc = 42,400 Dong.

Use

- Bio-Plant (8 cc) + Pro-Plant (30 cc) + water (30 litres) was sprayed over the 500 m² area 4 times: 3 times every 21 days and again at harvesting time.

Results

- The Test Area using bio-fertilizer produced 215 kgs. of mulberry leaves at a selling price of 10,000 Dong/kg. = 215,000 Dong. Deducting the expenses - 215,000 - 42,400 = 172,600 Dong profit over an area of 500 m².
- The Comparison Area produced 200 kgs. of mulberry leaves at a selling price of 10,000 Dong/kg. = 200,000 Dong. Deducting the expenses - 200,000 - 80,000 = 120,000 Dong over an area of 500 m².
- As a result, over the area of 500 m², the Test Area using the bio-fertilizers had a higher profit of 52,000 Dong in comparison with the Comparison Area, which used the old system of chemical fertilizers. This represents an increase in profit of 70%.

Summary of the Test Results

- Mulberry grew faster and produced more leaves compared to the Comparison Area.
- The mulberry plants grown using the bio-fertilizers grew 10-20 new leaves each, but the mulberry in the Comparison Area grew only 9-10 new leaves. Also, the mulberry grown with the bio-fertilizers produced thicker and larger leaves.
- The mulberry grown with the bio-fertilizers were more resistant to pests and there were fewer weeds.
- The mulberry grown with the bio-fertilizers produced more leaves than in the Comparison Area.
- There was no need to separate the mulberry leaves for the silk worms to eat, but the leaves of the mulberry grown with urea had to be separated after 10 days.
- The silk worms that ate the mulberry leaves on the plants grown with the bio-fertilizers had 7% more to feed on than those in the Comparison Area.

2. Test Type 2: Before using the bio-fertilizers, the mulberry plants were cut to 90 cm. in the Test Area of 500 m².

- In the Comparison Area (500 m²) chemical fertilizers were used, i.e. NPK (5-8-5) 50 kgs.
- In the Test Area, the bio-fertilizers were used without cutting the mulberry plants. The average height of the mulberry plants was 2.4 m.

The Test Area Used the Bio-fertilizers as follows:

- 1st time (16 Aug, 2004): NPK (5-8-5) (20 kgs.) + Bio-Plant (60 cc) were sprayed over the mulberry plants.
- 2nd time (21 Aug, 2004): Bio-Plant (8 cc) + Pro-Plant (30 cc) were sprayed over the mulberry plants.
- 3rd time (26 Aug, 2004): Bio-Plant (8 cc) + Pro-Plant (30 cc) were sprayed over the mulberry plants.

The result was that the mulberry plants produced many more fresh leaves and branches; the leaves were thicker and a fresher green; and there was more shadow than in the Comparison Area where the leaves were yellowish and grew slowly. In the Test Area there were 15 leaves per branch while in the Comparison Area there were 10 leaves per branch. Also the soil in the Test Area absorbed more water.

Test Results 8: Rice

The Use of Bio-Plant and Pro-Plant on Mulberry and Rice at Tambol Teaohdo, Amlplur Teaohwah, Tauwah Province 27th July 2004

1. Basic Information About the Tests

- The test took place at Tambol Teaohdo, District Teaohwah on 30th June 2004 during the rice growing season.
- The bio-fertilizers were used with rice **CL9** of the Agricultural Spore Research Institute, and it was conducted by Mr. Wiauh Hueh Hung and Mr. Ngeauh Ngok Tungh.
- Test Area (using bio-fertilizer) was 1,000 m² in size.
- The Comparison Area (using chemical fertilizers) was 500 m² in size.

2. Test Area Fertilizer Use

- In the Test Area, the committee decided to use 50% of the amount of chemicals used in the Comparison Area. The use of the bio-fertilizers was as follows:

Time of Spraying	Period of using	Area 500 m2			Support fertilizer (kg.)
		Bio-Plant	Pro-Plant	Total	
	Fertilizer				
1 time	Adjust soil condition	60 cc.	0	60 cc.	manure 500 kg NPK 20 kg.
2 time	After putting rice seed 10days	8 cc.	30 cc.	38 cc	urea 3 hg. K fertillizer 3 kg.
3 time	After putting rice seed 20 days	8 c.c.	30 c.c.	38 c.c.	urea 3 kg.

3. Costs

- Bio-Plant /Pro-Plant 250 cc at a cost of 278 Dong per cc. = 69,500 Dong
- NPK (5-8-5) 20 kgs. at a cost of 1,300 Dong per kg. = 26,000 Dong
- Urea 7 kgs. at a cost of 4,000 Dong per kg. = 28,000 Dong
- Potassium 5 kgs. at a cost of 4,000 Dong per kg. = 20,000 Dong
- Total Cost = 143,500 Dong**

4. Comparison Area Fertilizer Use

Chemical fertilizers were used as follows:

Step	Period of using fertilizer	Area 500 m2			
		manure	Urea	Phosphorus	Pottassium
1	living	500	10	35	0
2	After putting rice seeds 10 days	0	5	0	5
3	After putting rice seeds 45 days	0	0	0	5
	Total	500	15	35	10

5. Costs

• Pesticides		=	15,000 Dong
• Phosphorus	35 kgs. at a cost of 1,100 Dong per kg.	=	38,500 Dong
• Urea	35 kgs. at a cost of 4,000 Dong per kg.	=	60,000 Dong
• Potassium	10 kgs. at a cost of 4,000 Dong per kg.	=	40,000 Dong
Total Cost		=	153,000 Dong

6. Summary

- The cost of the fertilizers was not much different.
- The soil where the bio-fertilizers were used was softer than in the Comparison Area where it was quite hard.
- The rice grown with the bio-fertilizers grew better and was greener than the rice in the Comparison Area.
- In the Test Area the rice plants had more stems in a bunch than in the Comparison Area.
 - Test Area: a bunch had on average 9 stems.
 - Comparison Area: a bunch had on average 8 stems.
- There were much fewer weeds in the Test Area.
- The rice in the Test Area was more resistant to pests than in the Comparison Area.
- On 18th August 2004, it was necessary to apply pesticides in the Comparison Area, but pesticides were not needed at all in the Test Area.
- In the Test Area the rice produced seeds 3-4 days before the Comparison Area.

Reported by:
Mr. Wiaugh Ngob Tung
Agricultural Co-op President Deputy

Agricultural Association T. Teaohdo
Mr. Wiauh Huah Houh