Biosecurity and Crop Enhancement For Nigeria And the African Agricultural Market

GLOBAL
Infection Control Consultants LLC

May 2016. Benue State, Nigeria

Factors Affecting The Agricultural Market

There are some basic factors required for proper plant growth. Geography and climate play a major role. These basic factors include:

I. Light
II. Temperature
III. Water
IV. Nutrition

Light

Light is an essential factor and must be present

I. Sufficient quantity: Varies season to season and is required for photosynthesis.

II. Sufficient Quality: The color or wavelength reaching the plant surface affects growth.

III. Sufficient duration: The amount of time that a plant is exposed to sunlight affects growth depending on the particular type of plant.

Temperature

Temperature affects the productivity and growth of a plant depending on plant variety.

I. High temperatures can cause increased respiration sometimes above the rate of photosynthesis.

II. Low temperatures can result in poor growth because photosynthesis slows at low temperatures.

Water

Water is a primary component of photosynthesis. It has many benefits including:

I. Transports nutrients throughout the plant

II. Provides pressure for root growth

III. Acts as a solvent for mineral uptake by plants

IV. Evaporation on exterior plant surfaces stabilizes temperature

Nutrition

Nutrition should not be confused with fertilization.

Plant nutrition refers to the needs and uses of the basic chemical elements in the plant.

These nutrients are found in air and water in addition to those already in the soil

Nutrients In Air And Water

Nutrients naturally available in air and water include the following:

I. Carbon
II. Hydrogen
III. Oxygen

Six Main Soil Nutrients

I. Nitrogen
II. Phosphorus
III. Potassium
IV. Magnesium
V. Calcium
VI. Sulfur

Additional Trace Elements

I. Iron
II. Zinc
III. Molybdenum
IV. Nickel
V. Manganese

I. Boron
II. Copper
III. Cobalt
IV. Chlorine

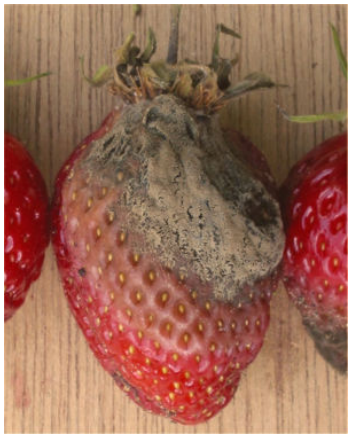
Absorption Of Nutrients

Under normal growing conditions plants absorb most nutrients, except carbon, hydrogen, and oxygen, from the soil. However, some nutrients can also be absorbed by the leaves if they are sprayed on with a dilute solution. The factors that affect absorption by the cell are still important because the nutrient must enter the cell to be used by the plant.

Fertilization

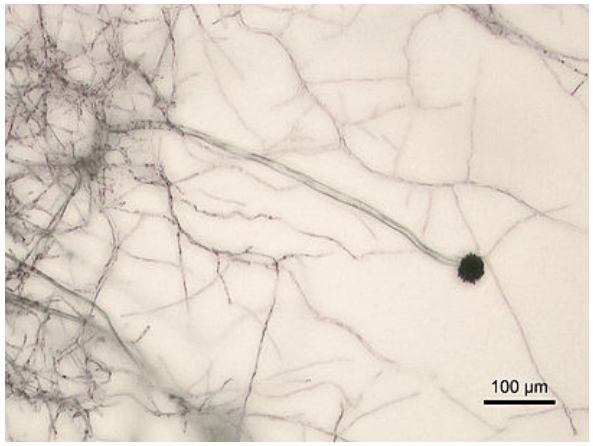
When we think of fertilizing plants and crops we generally refer to the addition of organic or man-made, synthetically formed products and substances with the goal of enhancing plant growth or preventing the growth of pathogens or parasites such as fungi, bacteria, yeasts or insects.

Pathogens And Pests - Fungi



Botrytis

Alternaria



Aspergillus *niger*

Pathogens And Pests - Bacteria

Erwina (wilt)

Pseudomonas *syringae*

Spiroplasma

Pathogens And Pests - Insects

Whitefly

Cucumber beetle

Aphid

Some Of The Major Nigerian Crops

- Beans
- Sesame
- Cashew nuts
- Cassava
- Cocoa beans
- Palm oil
- Maize
- Plantains
- Rice
- Soybeans
- Yams
- Melon

Historical Problem Solving Solution

The normal solution to problems associated with fungi, bacteria and insect pests has been the application of pesticides and insecticides.

This has been done alone or in combination with fertilizer to enhance plant growth and production (2 step process).

Pesticides and Fertilizers

Pesticides have typically been synthetic.

Fertilizers have been organic or synthetic.

Organic fertilizers come with issues of bacteria, fungi, fecal coliforms and other pathogens.

Synthetic fertilizers and pesticides come with issues of chemical toxicity to the earth as well as potential residual in crops that can and do get into the food chain.

Chemically Synthesized Pesticides Environmental And Economic Costs

Most benefits are based on direct crop returns without consideration of environmental and human consequences

- Human Health effects
- Domestic animal poisonings
- Destruction of beneficial pests
- Development of pesticide resistance
- Honeybee losses
- Groundwater contamination
- Fish loss
- Micro-organism loss
- Wildlife poisonings

Neonicotinoids….A Modern Day Example

Neonicotinoids are a relatively new class of insecticides launched in 1991. They are synthetic derivatives of nicotine, the toxin found in tobacco.

Nicotine has been used as a pesticide for 200 years but it degrades quickly. New synthetic derivatives are designed to be persistent and last longer.

Mode of action is to attack the insects nervous system.

The Problem….Seven Active Ingredients

Ingredient	LDL50	More Toxic
Acetamiprid	1,065 mg/kg	**93.9 X***
Clothianidin	3,044 mg/kg	**32.8 X***
Dinotefuran	2,000 mg/kg	**50.0 X***
Imidacloprid	2,591 mg/kg	**38.6 X***
Nitenpyram	1,575 mg/kg	**63.5 X***
Thiacloprid	444 mg/kg	**225.0 X***
Thiamethoxam	1,517 mg/kg	**65.9 X***

* = x more toxic than Path-Away®

Residue Issues in Crops

Because they are systemic pesticides the *Neonicotinoids* ***will occur as residue in foods*** and will ***not*** wash off. The residues do not breakdown rapidly and are unchanged by processing. In the USA residues were found in:

I. 80% of bananas

II. 76% of cauliflower

III. 72% of spinach

Poisonings

Fatalities from ingestion

I. China
II. India
III. Iran
IV. Portugal
V. Sri Lanka
VI. Taiwan
VII. Turkey

Symptoms

I. Vomiting
II. Headache
III. Loss of consciousness
IV. Respiratory failure
V. Liver/kidney failure
VI. Coma
VII. Death

Acute Toxicity

Inhalation Route Symptoms

I. Reduced activity
II. Coordination loss
III. Tremors
IV. Diarrhea
V. Weight loss
VI. Dizziness
VII. Nausea

Ingestion Route Symptoms

I. Drowsiness
II. Dizziness
III. Disorientation
IV. Fever
V. Sweating
VI. Increased heart rate
VII. Increased respiration

Chronic Toxicity

Chronic health effects can be more severe. Along with reduced weigh gain, liver damage and reduced blood clotting, studies have found:

I. Long term health effects on offspring (children)
II. DNA damage
III. Chromosomal aberrations
IV. Some mutagenicity has been discovered
V. Endocrine disruption to thyroid
VI. Reproductive and developmental toxicity

Environmental And Ecological Effects

UNEP, *United Nations Environment Programme,* has reported that certain fungicides have synergized with *neonicotinoids* to increase their environmental toxicity up to 1,000 times.

Studies have shown synergistic fungicides in combination with *neonicotinoids* have been found together in pollen.

Neonicotinoids are regarded as a cause of drastically reduced insect life in Europe including moths and butterflies. This has reduced numbers of insect eating birds.

Honeybee CCD (*Colony Collapse Disorder*)

Honeybees pollinate 90% of the world's crops, including fruits and vegetables. *Neonicotinoids* have irreversible effects on the nervous system of bees. Continual exposure even in very small amounts has a cumulative effect eventually breaking down the the nervous system of bees as well as their immune system.

The results is CCD, ***Colony Collapse Disorder***

LDL50 Results For One Field Trial

In a field experiment using treated maize seed, the levels of *neonicotinoids* found in the drops of sap on the tips and edges of some vascular plants were:

254 X the allowable LDL50 for *imidacloprid*

280 X the allowable LDL50 for *clothianidin*

48 x the allowable LDL50 for *thiamethoxam*

USDA 2014

Other Toxicity Issues

I. Toxic to natural enemies of spider mites

II. Acutely toxic to earthworms

III. Acutely toxic to soil dwelling arthropods from seed treatments

IV. May inhibit leaf litter breakdown because of toxicity to decomposer invertebrates

Serious buildup of Pest Resistance

Pest resistance has been documented in

I. India

II. China

III. Thailand

IV. Vietnam

New reports are coming in from other countries and are being studied in detail

Environmental Contamination Effects

Countries such as the USA and Netherlands have reported residues in groundwater.

1. ***Imidacloprid -*** Half life of up to 997 days in one USA field
2. ***Clothianidin –*** Half life up to 6931 days (19 years) with residue found in soil 2 years after treated seed was sown
3. ***Dinotefuran -*** Half life up to 138 days, some metabolites at 459 days

The Future Of Crop Protection/Propagation

Organic

Global Organic Farming Hectares 2014

I. Oceania (17.3 million hectares or 40 percent of the global organic farmland).
II. Europe (11.6 million hectares or 27 percent of the global organic farmland).
III. Latin America (6.8 million hectares or 15 percent).

Increase of 0.5 million hectares over previous year

IFOAM
INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS

2015

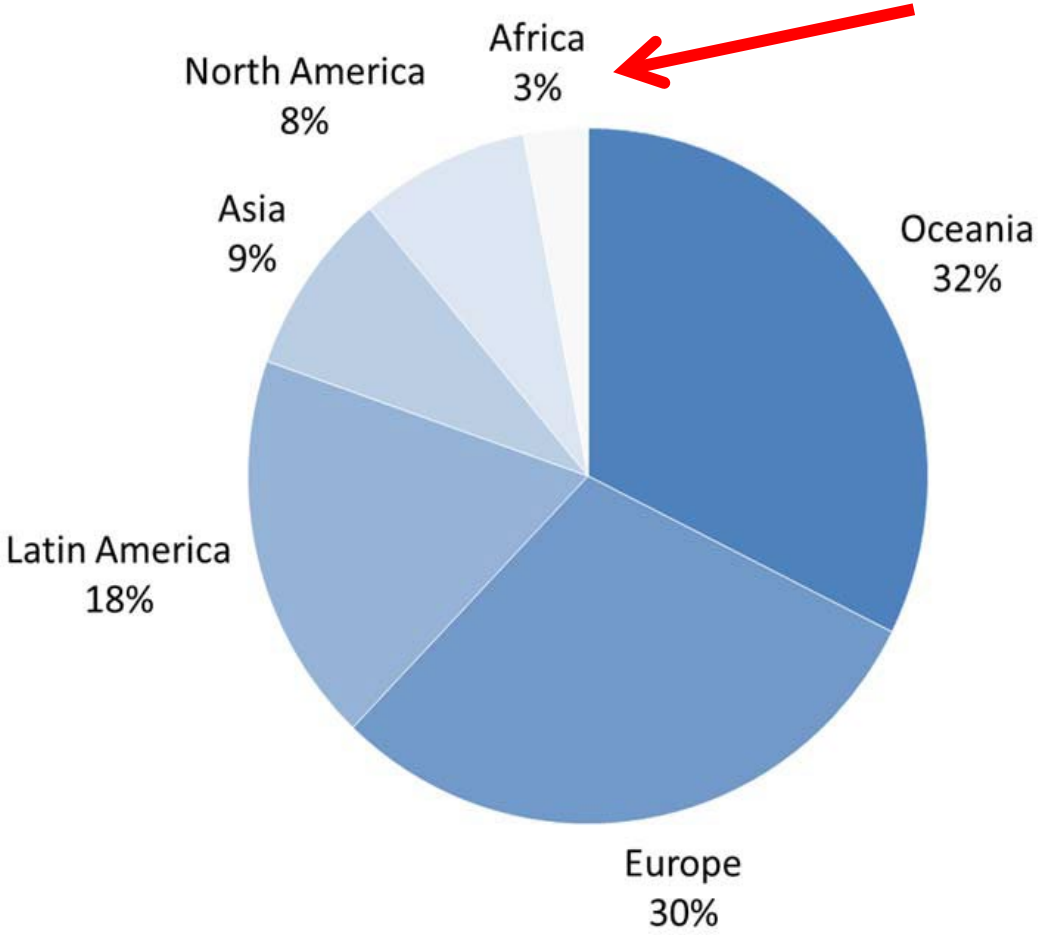
Highest Organic Farming Countries

I. Australia (17.1 million hectares)
II. Argentina (3.1 million hectares)
III. United States (2.2 million hectares)

IFOAM
INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS

Distribution of organic agricultural land by region 2012

Source: FiBL-IFOAM Survey 2014



IFOAM
INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS

Nigerian Resource Available

UNIVERSITY OF IBADAN

...the first and the best

Most Important In Nigeria

VISION

To Safeguard the Public Health of the Nation...

MISSION

To safeguard the public health by ensuring that only the right quality food, drugs and other regulated products are manufactured, exported, imported, advertised, sold and used.

NATIONAL AGENCY FOR FOOD AND DRUG ADMINISTRATION AND CONTROL
NAFDAC
...Safeguarding the health of the nation

Monday, 29 February 2016 08:40

NAFDAC Warns Against The Use Of Wrong Pesticides

The workshop was held in Minna

Acting Director General of NAFDAC, Mrs. Yetunde Oni assured Nigerians that NAFDAC in collaboration with relevant stakeholders are working assiduously in effectively monitoring the various steps involved in the food production chain to ensure the circulation of safe and wholesome food to meet the nutritional needs of the Nigerians.

I. Why Consider Organic

I. Low or no toxicity and no chemical residue
II. No damage to the soil for future crops
III. Eliminate pollinating bee deaths
IV. No damage to water table
V. No loss of animal life
VI. No special equipment needed for application
VII. Reduce/eliminate human health issues
VIII. Stewardship to the earth.

Applying Chemical Pesticides

Protective clothing and gear needed

Applying Path-Away® Plant Protectant

Dr. Arlene C. Alegre applying Path-Away® In the Philippines

How Do You Logically Proceed

Moving to organic requires a ***Committed Client***, a ***Qualified Consultant*** and an ***Accredited Product***.

I. Identify …….. The problem
II. Quantify …….. The damaging agent(s)
III. Rectify …….. Institute a structured program

What is the M3 System®

The M3 System® is a structured methodology, carefully crafted after years of laboratory and field experimentation that is applicable to numerous segments of the agricultural and food processing industries.

It was created, tested and then Trademarked by Arthur V. Martin, the *Principal Research Scientist* and *President* of Global Infection Control Consultants, LLC. USA. Art's work of more than 40 years in more than a dozen countries has received numerous peer reviewed awards including the 2011 Kochon Prize nomination for his work in controlling airborne Mycobacterium *tuberculosis.*

Emphasis is placed on natural based, sustainable methods/materials.

Arthur V. Martin Ph.D.
President
Engineer Scientist Lecturer
WHO Kochon Prize nominee

GLOBAL
Infection Control Consultants LLC

The M3 System® Explained

M1=Measure: We establish a baseline pathogen matrix of the product or process in question through testing and analysis.

M2=Manage: We formulate a precise protocol based on laboratory results to mange pathogen levels that will enhance sustainability.

M3=Monitor: We structure a comprehensive long term program with guidelines to monitor results that will keep the product or process safe and on track with client goals.

The M3 System® for Agricultural Application

The pathogenic organism is identified and quantified. This is done through laboratory analysis by a certified microbiological laboratory.

Our scientists and engineers formulate corrective measures and structure a plan of action than can be implemented quickly, efficiently and cost effectively. ***Emphasis is placed on products that are natural based and contain no drugs or added chemicals.*** They must be environmentally neutral and not leave behind a problem worse than the one being treated.

The M3 System® Application Follow-Up

Follow-up is required to ensure compliance with the protocol that is established. This is done in several ways.

- Field visits by our personnel
- Periodic testing and lab analysis to quantify contaminants
- Adjustment of protocol as needed to achieve optimum results
- Data analysis by our interactive, web based reporting system.

M3 System® Project Example

"GAAW Ltd is currently involved with the Psa contamination issue devastating the Kiwi crop. We brought in Arthur V. Martin of GICC LLC in the USA and his M3 System®"

"The Psa problem was already identified so we moved directly into formulating a protocol utilizing the most effective methodology and materials available. After a review of products currently used including *Copper Dust,* which is not environmentally friendly in the long term, and Key Strepto, a product containing *Streptomycin Sulphate,* a product called Path-Away® Anti-Pathogenic Aerosol Solution was decided upon as a potential solution."

K. Grimshaw, Pres. GAAW

Auckland, N.Z.

Path-Away® Anti-Pathogenic Solution

- USA EPA Exempt
- Natural plant based formula
- Scientifically developed in the USA
- 10+ years of field trials
- No added chemicals
- No drugs
- No alcohol
- Biodegradable
- Totally soluble

- Certified Organic + no GMO
- Proven effective on Psa
- Tested by NZ Plant & Food
- Approved by NZ EPA
- Path-Away® Anti-Pathogenic Solution Concentrate Pre-Mix: HSNO Approval Code #HSR100548
- Path-Away® Anti-Pathogenic Solution 2.5% Mix: HSNO Approval Code: HSR100549

Path-Away® Plant Protectant

NATIONAL AGENCY FOR FOOD AND DRUG ADMINISTRATION AND CONTROL

NAFDAC

...Safeguarding the health of the nation

Registration Number
BioGro #5479

Adaptation Of The M3 System® To Biosecurity Issues Related To Kiwi Fruit

- Kiwi industry is a 1.5 billion dollar industry for New Zealand
- Time and effort had not produced successful results
- The introduction of products such as Path-Away® brought environmentally safe solutions to the problem at hand.
- The New Zealand Government/Zespri approach is to carefully evaluate methods and materials through lab testing, glass house trials and field trials prior to application.
- The M3 System® approach offers proven alternatives backed by New Zealand's own laboratory testing and EPA approvals.

Path-Away® Vs. KeyStrepto

Used on Kiwi Fruit in New Zealand

Path-Away®

- Standard ASHRAE ventilation
- No respiratory mask needed
- Can be used as a hand sanitizer
- Acute oral LD50 rats 200,000 mg/kg live body weight.
- Non-toxic to aquatics at <5% concentration.

KeyStrepto

- Toxic if inhaled
- Approved organic vapor respirator required
- Moderately toxic via skin contact
- Acute oral LD50 rats 9000 mg/kg live body weight (22x more toxic than Path-Away®)
- Highly toxic to environment

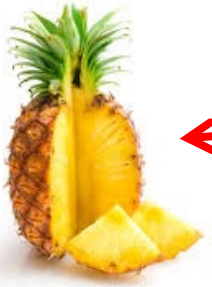
Adaptation Of The M3 System® To Biosecurity Issues Related To Kiwi Fruit

- Protocols take into account the "human" issue of the problem.
  An article in the Sunday Star Times 23/10/2011 indicates that *"Growers admit their hygiene standards were not as good as they could have been. Simple things like spraying shoes or sterilising pruning equipment – standard practice in other areas of horticulture – were not done. It is now thought the disease could have been here for a year or more before it was discovered, and was spread through poor hygiene practices."*
- GAAW Ltd constantly evaluates competitive products. As an example from the same article named above *"Boring old drainwater could help save the kiwifruit. Water, along with almost everything in nature, contains bacteriophage "phage'' for short which are viruses that attack and kill other bacteria. The only downside is that the viruses don't last for long periods when exposed to UV light."*
  Path-Away® is U.V. Tolerant and thus a superior product.

Successful Path-Away® Agricultural Results

We implemented the use of Path-Away® to resolve fungal and/or bacterial issues with:

Kiwi fruit in New Zealand



Pineapple/Coconut in Philippines

Dragon fruit in SE Asia

In each case the crop was being threatened by a natural fungi or bacteria.

Application of Path-Away® on the plants eradicated the problem.

Successful Path-Away® Agricultural Results

We implemented the use of Path-Away® to resolve fungal and/or bacterial issues with:

Strawberries in the Philippines

Maize in Nigeria

Rice in Nigeria

In each case the crop was being threatened by a natural fungi or bacteria.

Application of Path-Away® on the plants was successful against the attacking pathogen.

Thank You

GLOBAL
Infection Control Consultants LLC

www.giccllc.com