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South Africa's Organic sector body formed

Over the last two years the government has funded the development of a "Value Chain Strategy for the Development and Growth of Organic Agriculture".

Commissioned by the DTI in partnership with the Department of Agriculture through FRIDGE (the Fund for Research into Industrial Development, Growth and Equity) and lead by the INR (Institute of Natural Resources), the study included workshops across South Africa to get broad involvement in the process.

The strategy was presented at a workshop on 8 May this year at the St George Hotel near Pretoria to past participants who were able to attend. Break away groups were formed and issues raised in response to the strategy. At these, representatives were nominated to form an interim body with an interim name – South African Organic Sector Organisation (SAOSO).

The organization's aim is to:

- Optimise the South African Organic Sector by -
- Promoting organic and agro-ecological practices in line with IFOAM's definition and principles;
- Creating an enabling environment through effective relationships and systems; and,
- Realizing economic, social and environmental value from local and global markets

SAOSO will work closely with representatives of government in a larger body currently referred to as the Organic Sector Strategy Implementation Committee (OSSIC). SAOSO is being constituted, to be finalised with a workshop in October in the Western Cape.

Please do not publish as yet. The name SAOSO might change! Please contact Ian via his web-page for further information on SAOSO. THANK YOU!

By Dr. Strauss Ferreira and Hans Klink: www.agroorganics.co.za

Organics in Perspective

This summary is aimed at the perceptions that are accepted as factual, but that is not always based on realities. Populist viewpoints often cloud organics, and tend to impede decision-making in practice.

There are 6 articles that can be published as stand alone! You are welcome to just that. Please contact me, should you feel the need. Thank you. Hans

A. 10 Good reasons for organic agriculture:

This article is inspired by the work of Ed Hamer and Mark Anslow. Their publication is available for review at <http://www.theecologist.org>.

1. Yields

Conversion to organic agriculture will show different results in different geographical locations, as well as variations dependant on one's existing management system. Studies in less industrialised nations show that when farming according to organic principles, yields increase substantially. A study of 286 organic conversions in 57 countries show an average yield increase of as high as 64%. The situation in industrialised countries is more complex. Opinions vary greatly on what the result of conversion would be. In essence it is shown that yields might decrease by around 15%, but this drop is reversed over time, and eventually an increase is the result in the longer term. Some crops are currently not suitable for organic management, and resultant drop in yields of between 30% and 60% can be expected. It is however a fact that organic agriculture - even with our current knowledge - offers a workable alternative. And as skills develop in this management system, it can become an industry leader in food production.

2. Energy

Currently we consume 10 calories of fossil fuel energy to produce one calorie of food energy. If one takes the IFOAM (International Federation of Organic Agriculture Movements) initiative to link organic systems to a direct box marketing system into consideration, energy savings as high as 90% could be achieved. Organic agriculture is hardly "energy free", but has the potential to be energy independent, and even an energy exporter. This dream was proposed by George Chan and is based on the principle of bio-digesters, where waste is converted into methane and compost.

3. Greenhouse gases and climate change:

It is not solely the energy saving (or energy export) that should be considered here, but factors concerning fertilising.

- Firstly: Ammonium nitrates are not allowed in organic agriculture. In the production of the above, nitrogen oxide is released which causes around 320 times the warming of CO₂. In addition, 6.7 tons of CO₂ is released with every ton of ammonium nitrate.
- Secondly: Techniques to improve soil fertility by carbon sequestration are practised. Within the organic context, soil is seen as a nursery for soil microbes, and with crop rotation and the use of companion planting, there is an improvement in the spread and depth of root mass. A study in this regard was conducted at the Rodale Institute in the US, and this showed that 73% of the Kyoto accord's CO₂ reduction targets could be reached by 100% organic soy and wheat production in the US.

4. Water Consumption

Agriculture is the thirstiest industry, and uses around 72% of the world's fresh water with indications that around 80% of the resources are already being overused. This situation is brought about by world trade, which resulted in grain making up 85% of plant-based calories. Wheat, maize and rice are the champions of water use - and the

current production methods exacerbate the situation mainly because of soil compaction and erosion.

Organic agriculture is different: the focus is on the creation of healthy soils and soil structure, which improves soil hydration.

Again the Rodale Institute showed in a 25-year experiment that higher yields were consistently achieved even under drought and flood pressure. A further advantage is that organics aim to support plant physiology by basing plants in their suitable climatic zones.

5. Ecological Impact

Organic farms support biodiversity, both above and below ground. Production systems are designed and managed to be in harmony with the environment to limit pests and diseases. A healthy ecosystem is an asset, and not a stumbling block for production

6. Farm location

Due to globalisation, food gets transported over long distances, and makes up 25% of total freight volumes. It was calculated in England that the average meal travelled a 1000 miles from farm to plate.

At their founding, IFOAM set themselves to not just promoting organic agriculture, but also “local and organic”. They support “local food - for local people”. In our current economic climate, it is crucial that we adjust our consumption patterns to an achievable and sustainable system.

7. Pesticides and synthetic fertilisers

It is shocking to realise that pesticides increased from 22 to over 450 in the last 45 years. In England a half a kilogram of pesticide is used per person. This development is an increasingly downward spiral. This is due to the lack of efficacy of pesticides because of increased resistance, lower disease resistance of crops, the loss of biological and natural enemies to pests and shortened food chains.

Organic farmers limit themselves in the use of pesticides and aim toward a system where no pesticides are necessary. It stands to reason that healthy soil will produce healthy plants with increased resistance to pests and diseases. The absence of artificial fertiliser lowers growth rate, but the plants have stronger cell walls and more fibre which reduces the destructive impact of pests. At the same time it lowers excess water retention, which makes the plant more stress resistant and therefore more resilient.

Further mechanical prevention lies in crop rotation, companion planting and diverse microbial soil life which push pests and disease below the economic pressure limit.

8. Nutrition

Scientists researching the statements of higher nutrition in organic food are finding increasing proof that there is more behind these statements than what is immediately apparent.

In 2001 the Journal of Complementary Medicine reported that 21 organically grown essential foods had higher levels of iron, magnesium, phosphor and vitamin C than the conventional equivalents. The organic foods also had lower levels of nitrates – and important distinction, as nitrates could be toxic. Other studies show generally higher levels of vitamins as well as polyphenols and antioxidants – well-known agents

in the prevention of cancer. Organic milk offers the best example of measurable difference: Omega3 amino acids, Beta-carotene and vitamin E levels are noticeably higher in organic milk, and pesticide residues and antibiotics measurably lower.

9. Seed Saving

Seeds are not just food; they represent more than 10 000 years of agricultural taming. It is tragic that nearly 75% of genetic diversity disappeared in the last 100 years. Traditionally the seeds of stronger plants were kept for the following growing season, which created natural breeding i.r.o pests, disease and climate adaptation within regional context. Modern hybridisation curtailed this. With the advent of the Green Revolution and F1 seed technology, seeds were commercialised. The problem does not just lie with economic exploitation, but also in the fact that interdependency between seed and inputs (weed killer, pesticide, fertiliser, etc.) is being developed. Here organic agriculture should play an important role to retain plant material within a regional context and to adapt it systematically to its environment.

10. Job Creation

Organic agriculture breaks away from the Green Revolution management model which set itself as input-driven. The maintaining of balance needs better monitoring and detailed actions. The closer one moves to a perfect system, the use of input products decreases. The saving of input products does require an increase in labour, which needs to be sourced locally.

In 2006, research by the University of Essex showed that organic farms created 32% more jobs in England than the conventional counterparts.

B. Organic regulation and certification

You now have 10 good reasons to consider organic agriculture as a framing system. Let us discuss the background of organic regulation and certification.

The IFOAM definition of organic agriculture reads as follows:

Organic agriculture is a production system that promotes the well-being of the soil, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with harmful effects. Organic agriculture links tradition, innovation and science for the benefit of our shared environment in order to promote fair relationships and an improved quality of life for all involved.

This definition follows from the four principles of organic agriculture that can be viewed on their website at www.ifoam.org. In essence it is about health, ecology, fairness and care which should be sustainable, and this is exactly where the relationship lies between sustainable agriculture and organics.

Organics can therefore be viewed as certified sustainable agriculture.

IFOAM set out a norm that can serve as a practical guideline to conform with the four principles of organic agriculture.

This norm is now used by governments as guideline for the application to regional (local) conditions related to ecology, tradition and local knowledge. The end product is then a local organic regulation which is recognised by the WTO (if the process is followed correctly) as the organic standard of the region. This result in systems like the EU regulation, NOP, JAS, BSA and others that are legally binding i.r.o trade in products labelled as organic.

Certification is an audit of the farming system to be managed according to such a regulation. There is a real danger that major obstacles can be experienced when attempting to farm according to a “foreign” regulation. In this respect IFOAM, in partnership with the UN Food and Agriculture Organisation (FAO) and Conference for Trade and Development (UNCTD), developed an accreditation system which is currently practised. With this strategy, the original aim of certification – namely the integrity of organics – will be promoted, rather than the grip that private certifying bodies promoting their own brand has on the industry. This will result in the principle of fairness in organic agriculture.

Certification should not be linked to the brand of a certifying body, but to organics. This sensitive issue should be clear when looking at certification from one body that is not recognised by another.

Organic agriculture operates within the boundaries of a regulation which has sustainability with limited input products as its basis. Certification is an audit to ensure that that a system is operated within the regulation and that the consumer is assured of the INTEGRITY of the PRODUCT, rather than promoting the certifying body’s brand name.

C. Organic management

Conventional agriculture is currently the following of recipes for crop protection and fertilisation from input suppliers. This system is refined through effective marketing of agriculture products to ensure high output percentages for the manufacturer!

In contrast, the organic farmer has no fixed recipe or protocol. The farmer must collect all the necessary information to create a system. The organic system rests on soil health, and the farmer must gain the necessary knowledge to manage the soil with life and sustainability. Healthy soil produces healthy plants which offer increased resistance to pest infestation and disease.

If we look at the basic principles of such a protocol, it would something like this:

- Insects: List all possible harmful insects, their enemies and establish the life cycle and habitat of both. Establish whether the pest is soil based and annual. Plan islands and corridors where a habitat for its natural enemies can be established. It is also important to establish whether the insect flies, jumps, crawls or is mainly static. This information can serve as benchmark when deciding to apply organic control products to prevent crop damage.
- Diseases: List all possible diseases that can occur on a specific plant, and the life cycle. Establish what the environmental factors are for the development of the disease and what the symptoms are. Plant in well-drained soil and plan rows and row widths for good aeration. Sometimes pruning methods can be applied for aeration.
- Soil: Do a comprehensive soil analysis and make adjustments through application of acceptable organic fertilisers in order to establish a homogenous soil condition. Establish soil microbial life through compost.
- Companion plants: These are plants that support each other i.r.o feeding, pest control, pollination and other factors that improve production. List all companion plants and their habitats as well as their space requirements. Plan rows and row widths in order to ensure sufficient root and growing space for companions. The aim is to attract the natural enemies of pests, and to establish good root spread to create living conditions for soil life.

It is necessary that a selection of variables is considered which, through good monitoring, can give an indication of the direction to be taken. The data of a weatherisation could be used to predict various occurrences relatively accurately. Soil moisture and plant stress readings can give a basis for soil health and feed deficit management. Inspection points and insect traps where insects (including natural enemies) can be counted, can give an indication of biodiversity. Available and acceptable organic control products are not just limited, but must be applied timeously and judiciously in such a way that the beneficials survive.

Computer technology will be utilised more and more to get the recipes or protocols into the public domain, and with the use of forums or blogs one could communicate directly with the creators of such protocols. Furthermore, the creators of protocols should use a minimum set of variables to measure where the system stands in relation to such recipes or protocols.

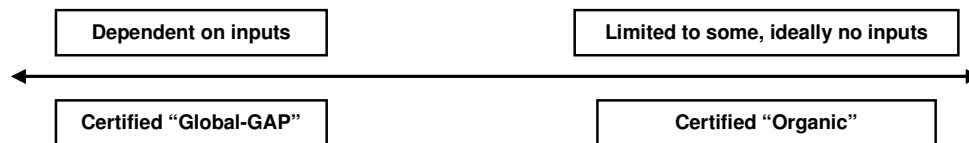
It is understandable that organic agriculture can be seen by some as a solution fro the small farmer, but not workable for the larger commercial farmer. It is said that the

small farmer can monitor his own small system and achieve relative success through trial and error. There is sufficient evidence of small farmers achieving success with organic agriculture – even in Africa – with tens of thousands of certified farmers in East Africa. There are, however, many examples of successful large scale organic agriculture.

Organic agriculture is not a new method, but a system gaining worldwide momentum and that is here to stay.

D. Organic agriculture in its economic context

Organic agriculture can also be described as a sustainable audited system on the opposite side of the scale to Global GAP.



Conventional farming systems are extremely dependent on input products like NPK salts, trace elements, pest and disease control products and also modern leaf feeding products. Due to pressure and focus i.r.o food safety, Global GAP certification follows which requires the control of such inputs in terms of frequency of use as well as requiring substantial reduction of residues to an acceptable minimum preferably zero.

The dependence on these inputs can be seen in the increase of input costs. The prices of these products are already high because of the regulation aspects around effectivity, food safety and environmental impact. The real cost of the products are hidden to some extent and creates an opportunity to build the dependency factor into the price.

A farming system based on inputs sets the tone for a price increase spiral where the input supplier can calculate his product price based on the market price of the harvest. The bigger the dependence, the better for the input supplier, as he discounts this in his price.

Especially the GMO's give us a point to ponder. The interdependence of especially weed control, certain pest control products and to an extent plant feeding products are under suspicion when assessing the price pincer.

The cost of inputs is well-known and varies little from region to region. The only countermeasure against input cost is the size of the farming business which gives the farmer the opportunity to avoid the middle man, limit logistical costs and negotiate bulk discount.

The organic system avoids this pincer effect and is particularly opposed to not just GMO, but also against the use of weed killers and only allows for input substances that are available in the public domain. All inputs have a traditional origin, and allowance is made for local or regional solutions to localised challenges, in such a way that organics benefit rather than individuals or legal entities.

The majority of information to set up an organic system is already in the public domain, but not always organised in such a way that it is recognisably organic. The monitoring variables are also not easily established, and it requires that the farmer does the research himself to acquire the knowledge. This challenges the farmer to collect information, implement and manage such a bio diverse system as organics. Many farmers are moving away from the exclusive use of inputs, and they do not just start putting life back in the soil, but are striving to create a natural or biological system. They do not want to limit themselves to what is allowed within the organic context, but would like to be able to use certain rectifying inputs from time to time. Farmers moving towards an input-free model, experience an initial increase in costs, but find that this is quickly reversed as they move away from input application

models. There are many examples of farms where this saving reaches 60%. Labour and monitoring costs do increase as a result, but the net. Input costs are around 20% lower.

Initially, the premium on many organic products is a bonus for the pioneering farmers, but will eventually not be the main motivator for conversion. The possibility of escaping from the input product vice grip will be the main factor in a farmer's decision to convert to organic management. For our regional economy, organic agriculture can offer a positive contribution on many levels: saving on input products (SA is a net importer); job creation and keeping money in local communities for longer. With the eventual price reduction in organic produce and the health benefits, cost of living can be significantly reduced.

E. Healthy Soils

Introduction

The principle points out that the health of individuals and communities cannot be separated from the health of ecosystems - **healthy soils produce healthy crops that foster the health of animals and people.** - IFOAM Principle of Health

Soil is often seen as dead matter, only good as a plant anchor. Good moisture retention is a bonus for irrigation, but that is where it ended. Choice of fertiliser is directly proportional to the yield potential, and ploughing limits weed growth, helps with water retention and promotes root growth

In this short summary the intention is to introduce you to the broad principles, which should give you the base to explore the finer details further. After studying this material, you should be able to support an organic farmer in his/her quest to maintain healthy soil.

Soil is the most precious resource on our planet. Healthy, living soil is the key to the plant kingdom and subsequent ecological diversity. Life can only function if the topsoil contains adequate organic matter with a good soil structure.

In nature, one finds that rain forests are extremely mineral/salt poor, due to high rainfall constantly leaching the soluble substances out of the soil. Despite tropical forests growing on “poor” soils, the biomass produced in 18 years is equal to a 100 years’ worth of agricultural production! Herein lies the simple answer: tropical soils produce on the foundation of active and diverse microbial life. Bacteria and fungi in the soil mobilise and retain minerals, salts and even silicon which are the available to plants for abundant growth.

The key to healthy soil lies in the maintenance of the soil’s micro life and therefore in the maintenance of the nutrient cycle serving this life. **The organic farmer does not feed his plants but the system feeding the plants.**

Soil Texture

Soil composition can be divided into two parts:

- Solids (rock fragments, minerals/salts and organic matter)
- Spaces (air and water)

The ration between space and solids vary from soil type to soil type. The organic component consists of plant matter and micro-organisms. Micro-organisms break down plant matter to humus and releases nutrients. There are billions of these micro-organisms in our soils that need to be fed, in order for them to release nutrients to the plants. Nearly 50% of the volume of healthy soil is space needing to be filled by air and water. Normally the ration of air to water should be 50:50 for optimal incubation and survival of microbes.

Ratio of elements

Rock fragments and minerals contain elements necessary for the balanced diets of the various life forms in the soil.

Due to economic pressure, one would always plant mainly one type of plant with some other species interspersed; sometimes as hedges or as temporary/permanent islands as support systems for an agro-ecological system.

Given this situation, a near homogenous soils structure across a large surface area is needed, and to achieve this, precision farming is needed.

There are various analytical models for the taking and analysis of soil samples, and even the interpretation of gathered data does not follow a single standard. In essence, the following need to be taken into consideration when supplementing and adjusting soil prepared for specific plant types.

The amount of various elements is not as important for healthy growth as the correct ratio.

For example:

- For every 100g K, a plant needs 1g B
- For every 35g P, it needs 1g Zn
- 500g Ca requires 1g Mn
- 1500 N requires 1g Cu, and so on.

Too much of one element, can cause a deficiency of another, which makes the plant susceptible to disease or pests.

Oversupply > Induced deficiency in

	N H4	NO3	P	K	Ca	Mg	S	B	Cu	Zn	Mn	Fe	Mo	Na
NH4	-	-	-	+	+	+	-	+	++	+	+	toks	-	-
NO3	-	-	-	+	+	-	+	-	-	-	-	-	++	-
P	-	-	+	+	-	-	+	+	+	++	+	+	+	-
K	+	-	-	-	+	+	+	++	+	+	+	+	+	-
+Ca	+					+	+	+	+	+	++	++	-	-
Mg				+	++					++	+			
S												toks		
B	For a complete table, see IFOAM website - Occurs rarely + Occurs occasionally ++ Occurs often													
Cu														
Zn														
Mn														
Fe														
Mo														
Na														

There are various approaches i.r.o the application of elemental deficiency which is mainly supplemented through irrigation or mechanical soil conditioning.

Where the soil is being worked, mixing is extremely important as homogeneity promotes even growth. The latest technology is being refined to mix soils up to 1200mm deep.

Any adjustment of elements should be seen as an event, and not as a process forming part of routine soil maintenance.

Living Soil

The biggest threat to any life form is imbalance. The effects of one-sided diets in humans are well-known, and results in health problems that could be fatal. As a child, we are always warned against the word “too”: Too much, too big, too little – too, too, too.

Now we will turn our attention to the most important life forms in the soil:

Earth worms

Earth worms eat organic matter and their castings contain nutrients for plant life. Furthermore, they tunnel the soil, and these tunnels increase the aeration and moisture infiltration of the soil. Earthworm tunnels can increase the water infiltration of soils 4 to 10 times compared to soils with no worms. Tilling can be replaced by earthworms. The soluble nutrients in worm castings are much higher than in the original soil. It is calculated that a good population of earthworms can manage approximately 10,000kg topsoil per hectare.

Arthropods

Arthropods are the primary refiners. They eat and tear down larger plant and animal residue. Some of them might even eat fungi. These organisms are macroscopic and include ants, snails and centipedes.

Fungi

Fungi break down organic matter and release nutrients from minerals. They are responsible for the initiation of the breakdown process of organic matter in and on the soil. Certain fungi produce plant hormones and others antibiotics such as penicillin. Others capture harmful nematodes. Mycorises is a group of fungi living in symbiosis with plants and contribute to the increase of root volume, which increases the plant's ability to take up water and nutrients.

Actinomycetes

- Like bacteria, they assist with breaking down organic matter into humus, and release nutrients.
- Produce antibiotics which fight root pathogens.
- They are responsible for the fresh smell of biologically active soil.

Algae

- Produce their own food through synthesis.
- Improve soil structure by releasing slimy substances which bind soil particles.
- Blue-green algae can fix nitrogen which can be released to plants.

Protozoa

- The most common is a bacteria-consuming amoeba.
- This accelerates nutrient release to plants.

Bacteria

- They are the most prevalent of soil microbes > 10⁶ bacteria cells per gram of soil.
- Some spp assist plants with nutrient uptake.
- Some spp release nitrogen, sulphur, phosphor and trace elements from organic matter.
- A few can fix nitrogen.
- Some break down minerals and release potassium, phosphor, magnesium and calcium. Some spp produce and release plant hormones.
- Others improve the uptake of plant nutrients, improve soil structure, destroy root pathogens and remove poisonous substances from the soil.

Nematodes

- Also make up a large proportion of soil microbes.
- Only a few species are harmful to plants.
- Most of them are harmless and eat rooting plants and dead materials.

Quantities

It is calculated that there are more than 1000 million micro-organisms per handful of fertile soil. A calculation of the mass of micro-organisms in the top 15cm of topsoil is summarized in the following table:

Table -Mass of soil organisms in the top 15cm of fertile soil.

Organism	Kg/ha
Bacteria	1000
Actinomycetes	1000
Fungi	2000
Algae	100
Protozoa	200
Nematodes	50
Insects	100
Worms	1000
Plant roots	2000

Bollen, 1959.

Nutrient Cycles

In our consumer oriented society, there is a perception that plant growth impoverishes soil by “using up” necessary elements. The only way for this to happen is to remove growth from soil completely, i.e. removing all plant matter so that the soil is stripped bare. If only the harvest is removed, the quantity of elements removed is normally so small that it could be supplemented by allowed inputs as published in the organic regulations.

It is important to have an understanding of nutrient cycles. The following is of extreme importance, and if maintained, will promote the more complex cycles:

Carbon cycle

- Carbon is *the* most important element in biological systems.
- It is the cornerstone of all cellular structures in living organisms.
- 0,03% of the earth’s atmosphere consist of carbon dioxide (CO₂)

- The sea contains 60% more CO₂ than the atmosphere.
- Plant and microbe cells contain 40-50% carbon.
- Plants fix atmospheric CO₂ through photosynthesis as carbon in plant cells.
- Humans and animals get their carbon from plants.
- With the plant or animal dying, carbon is broken down to humus.
- Humus serves as a long term organic source of carbon and nitrogen for m.o.s
- is the main factors in humus breakdown is:
 - The level of organic matter in the soil
 - Tilling practice
 - Temperature
 - Humidity
 - pH
 - Aeration

Nitrogen cycle

- 79% of the atmosphere is nitrogen (N₂).
- The atmosphere above 1 Ha soil contains 74 000 ton N₂.
- N₂ is unavailable to most organisms because of its threefold link.
- M.o.s. uses N₂ and converts it to ammonium (NH₄) or nitrate (NO₃), which can be utilized by plants (nitrogen fixing).
- 150 – 200 million tons nitrogen are used annually by plants.
- Only 10% is due to fertiliser. The remaining 90% is produced by nitrogen fixing.
- Most nitrogen fixing organisms are bacteria which are free-living or in symbiosis with plants.

Examples of nitrogen fixers			
Free-living		Symbiotic with plants	
Aerobic	Anaerobic	Legumes	Other
Azotobacter	Clostridium*	Rhizobium	Frankia
Beijerinckia	Desulfovibrio		Azospirillum
Klebsiella*	Sulphur bacteria		
Cyanobacteria*			
	* Some		

Phosphate cycle

- Decaying plant material is the main source of phosphate (P) in soil. In plants, phosphate is found in nucleic acids, phytin, phospholipids, co-enzymes etc.
- The main function of phosphates in plants is the accumulation and release of energy.(ATP)
- Micro-organism changes P by:
 - The change of the solubility of inorganic P.
 - Mineralization of organic compounds by releasing inorganic P.
 - Conversion of inorganic P in cell composition.
 - Oxidisation of P-compounds
- Inorganic compounds of P cannot be taken up by plants.
- Many soil microbes such as Pseudomonas, Mycobacterium, Bacillus, Penicillium and aspergillus can make P soluble.

- Micro-organisms produce organics acids that break down P and make it available.
- Mycorisa fungi help plants to take up P.

Sulphur cycle

- Component of protein and amino acids.
- Cycle in both sedimentary and gaseous form.
- The source of sulphur is the lithosphere (earth crust) – contains between 1 and 100kg sulphur per hectare. 45% to 75% of sulphur is in organic form.
- Sulphur (S) is released in the atmosphere by the breakdown of organic matter (H_2S)
- H_2S is immediately oxidised into sulphur dioxide (SO_2).
- SO_2 and water vapour creates Sulfurous Acid (H_2SO_3 - a weak sulphuric acid), which is carried to the soil by rain water.
- Sulphur in its soluble form is taken up by roots and built into plant cells and amino acids by cysteine. It moves through the food chain and is subsequently released by the decay of organic matter.
- Sulphide and sulphur is converted to sulphate by *Thiobacillus*.

What can be done to get our soil healthy?

The first step is soil analysis. There are many services available, and the choice of service provider must form part of the goal to create a living soil. Because the method of analysis and the subsequent recommendations are closely related, one should work within one holistic approach/method. After the rough adjustments are made, the process of kick starting nutrient cycles can begin.

This can be achieved by applying compost at 25 to 30 tons per hectare. The compost layer must be sufficient to prevent immediate drying out or wind dispersion. It could be worked in lightly where quantities are limited. Good compost is rich in microbial life, but to apply compost in effective volumes per hectare can be very expensive.

A second and much cheaper option is the application of compost tea. Many recipes for compost tea are available, but aeration of the water during the production of the tea is essential to promote the growth of the so-called aerobic microbes. The compost tea can then be applied to the soil by tractor sprayer or irrigation systems. It is extremely important to mulch (cover) the soil with straw or any other organic material. The mulching prevents the destruction of the microbes through UV light or drying out, but more importantly, it serves as food for the microbes and enables them to complete the various cycles of the food chain as mentioned earlier.

Weeds are plants that have no value in the specific agro-ecological system, and organic weed control is based on the understanding that beneficial plants or even companion plants are settled which would suppress the unwanted growth and germination. When even this limited growth is unwanted, the weeds are chopped down (not pulled out) mechanically, used as mulch or removed for composting. Remember that all **remaining root growth is a bonus for the soil's micro life.**

F. Organic pest and disease control

"The role of organic agriculture, whether in farming, processing, distribution, or consumption, is to sustain and **enhance the health of ecosystems** and organisms from the smallest in the soil to human beings." — www.ifoam.org

Introduction

Seen from an ecological perspective, a pest or disease threatening the plant is a sign of imbalance – an event that allows the specific pest or disease to dominate the system. A perfect biological ecosystem, where even the weather is constant will be so stable that no input products will be necessary. Unfortunately, such a system will allow no harvesting! The organic approach aims to create an agro-ecological system around a single (or a few) economically viable plant, where the environment is planned in such a way to establish a balance. Because it is an artificial situation, it lays the table for those who would benefit. It is therefore extremely important that the management system is based on accurate and detailed monitoring and careful adjustments.

The following comparison between current conventional and organic agriculture should not be seen as derogatory, but to illustrate the boundaries of the paradigm

The organic farmer sees his soil as a nursery for microbes which in turn provides the nutrients. These microbes are supported by the use of compost, organic mulching and carbon-rich substances and also by the creation of a deep and even root spread. This approach creates the platform for the maintenance of all food cycles that provides a balanced diet for the crops and thereby prevents certain pests and diseases. The conventional farmer utilises NPK salts which disturbs the micro life and creates and unbalanced diet for the crops.

The organic farmer accepts that he will sacrifice a part of his harvest to satisfy the beneficials and will only ensure that this loss is kept within acceptable limits. When he/she uses control products he considers both the harmful pest and its natural enemies.

The conventional farmer relies on input products guaranteeing the best possible output and his threshold values differ substantially – with zero values of both harmful pests and their beneficial natural enemies.

The organic farmer monitors all possible variables very carefully to prevent the scales tipping to the other side. The monitoring is a never-ending process which gives him the opportunity to make better predictions and to adapt his system constantly. He accepts that every planting is unique and dependant on its own proactive adjustments. The conventional farmer relies on a scheduled input application that does not vary from planting to planting, and that shows similar efficacy from region to region. Where a deviation of efficacy becomes apparent, the product gets replaced or rescheduled.

Both production systems wish to feed the nation, both have their challenges to guarantee food safety and security, but the choice lies with the farmer and his ability to handle the respective management system.

Input products

Within organic regulation, the farmer is limited in choice of pest control, which is selected based on their use in the framework of food safety. The first priority is not to be detrimental to the system and secondly to have an effectivity which makes the use economically viable. It should also be noted that some of the substances may only be applied where there is no acceptable or reasonable alternative.

Imbalances

The approach in the redress of imbalance varies greatly, because of little and often sketchy information with no chronological approach circumscribed to date. There is the viewpoint that the solution to pest and disease control lies in **biodiversity** in and on the soil.

Another position is to prioritise **plant nutrition** central theme, seeing a comprehensive diet as the plant's own protection against disease and pests.

It is therefore understandable that the use of **biological controls** is often seen as purely input substitution of conventional control products. What is important to note is that the allowed substances allows the conversion from one management system to another to be economically viable, and the reason is that they are not harmful to the organic system if used correctly.

In the approach to pest and disease control, it is important to have the full picture i.r.o. threat and defence. Adjustments must be in context and applied in small steps. Both pest and disease are reliant on the immediate environment and differences can be found in the solutions for problems within a few metres.

Golden Rules

A holistic approach is necessary, and boundaries are not fixed, they are variables.

The redress of one imbalance can create another.

- Everything starts with healthy soil. Get the micro-life going.
- Applicable water management is of great importance.
- Use only pest-free seed and plant materials. Plant timeously so that plants are strong enough when pest become active. Maintain spacing to limit competition.
- Plant crops suited to the region.
- Crop rotation can break disease and pest cycles..
- Companion plants, that could even be marketable in their own right, will not just create good root spread, but create habitat for beneficials.
- Good sanitation of planted areas, stores, pack houses, dwellings and refuse dumps are of cardinal importance..

Pest control

The approach in the control of pests lies in the knowledge of their life cycles, habitat, likes and dislikes and their enemies. The same applies to one's knowledge of these enemies.

- Life cycles: Two important factors in the life cycle is the relation between temperature/weather and the hatching of eggs/pupae and where this happens. The first factor can be of value to predict when the pest will appear, and the second where entomopathological bacteria can be applied.
- Habitat: Knowledge of habitat can help to adapt the environment to limit multiplication.
- Likes and dislikes: Colour, taste and fragrance will give rise to a choice of companion plants, living fences, islands and other aspects of landscape planning.
- Enemies: Knowledge here will assist to settle the beneficials in the area and to monitor their population.

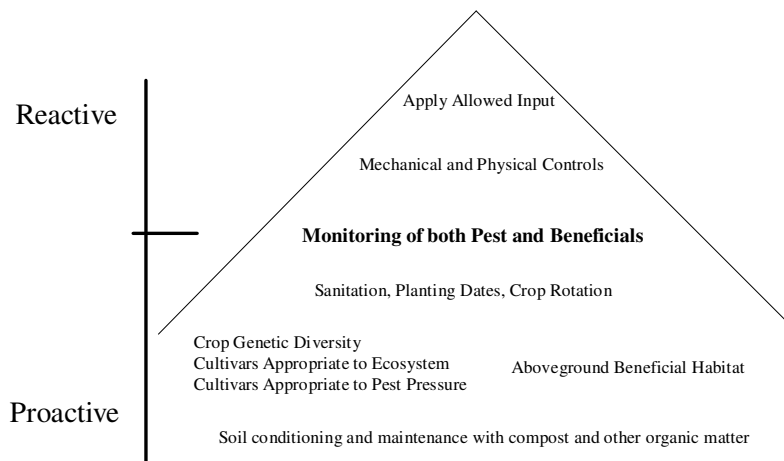
Disease control

Knowledge of life cycles, habitat, favourism to plant families, preferential weather, plant stresses promoting disease and monitoring variables are again the core of control.

- Life cycle: Timeframe and growth curves are of extreme importance when working with non-systemic input products, as these allowed products may only be used reactively and then only when micro parasites are involved.
- Preferential host and vectors: Here knowledge will find application when landscape planning is done. More complex than with insects, it has to be ensured that few hosts are present and that insects which are disease vectors are limited.
- Weather patterns: Most fungi, bacteria and virus outbreaks can be predicted with the help of weather station data and growth curves.
- Plant stress: measuring of plant stress is readily possible and could indicate water and nutrient surplus or deficiencies. Stressed plants are more susceptible to disease.
- Monitoring variables: Some diseases can be observed by the naked eye, but many cannot. Knowledge of variables that can be monitored is of great importance.

Conversion

Refer to the following graph. At conversion, and during the establishment of new systems, the graph emphasises where the main focus of planning should be to limit input products to their absolute minimum.



Summary

Organic pest and disease control is probably the biggest challenge for the organic farmer. The existing knowledge is not set out in a user-friendly manner, and makes management decisions very difficult.

The organic farmer must build up his own library and note all the relations. Only with the growth of this knowledge base, will the use of inputs be reduced significantly.

In the time where not all the information is structured for management decisions, one should not move away from the allowed inputs. The reason is twofold: the effect on balances is less severe, and it highlights problem areas which could be rectified within an environmental planning framework.