ENVIRONMENTAL MANAGEMENT

COLEAD

BROCHURE

4 SUSTAINABLE PRODUCTION PRACTICES

SOIL FERTILITY MANAGEMENT

Funded by the European Union

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This brochure is made available by the COLEAD to fruit and vegetable producers and exporters in the ACP (Africa, Caribbean, Pacific) countries. The illustrated procedures on the following pages are intended for growers facing a loss of soil fertility.

This brochure brings together the key messages and procedures to be followed in managing soil fertility.

Brochures on other subject areas are also available from (**www.colead.link**).

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INTRODUCTION

Soil fertility and its maintenance are a key concern in agriculture. A decline in soil fertility has repercussions for the subsistence of current and future agricultural populations. Reconstituting soil fertility is a slow and uncertain process. To protect and improve soil fertility before it deteriorates is therefore an essential objective for farmers.

The growth of the world population, and therefore of the need for food, means that food production per surface unit must be maintained, and if possible increased. Only a sustainable approach to soil fertility will make this possible, through the adoption of appropriate practices, to guarantee the maintenance of the production mechanism in the long term and consequently sufficient yields and income for farmers. A sustainable approach to soil management requires both a good understanding of the factors that contribute to soil fertility and control of the nutrient dynamics in the soil.

A fertile soil not only nourishes plants and provides them with a structured site for growth where they can develop roots and where air and water can circulate, but it also fosters growth thanks to numerous interactions between the roots of cultivated plants and soil micro-organisms (fungus, bacteria, nematodes, etc.).

Despite the complexity of this notion, it is fair to say that soil fertility depends on three distinct types of component elements:

1. **The physical properties of the soil (aeration, humidity, ease of tilling)**
2. **The chemical properties of the soil (efficient operation of the mechanisms for fixing nutrients and their exchange between the soil and the plant**
3. **The biological properties of the soil (intense microbial life contributing to plant nutrition)**

LIST OF KEY MESSAGES AND PROCEDURES FOR MANAGING SOIL FERTILITY

UNDERSTAND THE FACTORS INVOLVED IN SOIL FERTILITY

1. Soil fertility depends on the farming activities that give the soil its structure and make it possible to incorporate organic matter.
2. Soil fertility depends on it having a wealth of assimilable nutritive mineral elements as well as the nature, content and state of organic matter in the soil.
3. The microbial life of soil contributes actively to plant nutrition and health. It also contributes significantly to fertility.

IMPROVE SOIL FERTILITY

1. Apply rational inputs of organic manures and minerals to offset losses arising from harvesting.
2. Opt for associations that are beneficial to cultivated plant nutrition (development of bacteria and fungus on roots, certain bacteria fixing nitrogen from the air in the soil).
3. Adopt sustainable agricultural practices that protect the soil and foster microbial life.

PROTECT SOIL FERTILITY

1. Avoid salinisation of the soil due to irrigation with salt water and the use of certain forms of fertiliser (KCl).
2. Avoid soil loss through erosion. Retain trees in cultivated land parcels to exploit deep mineral resources.
3. Avoid soil compaction through trampling or the passage of machinery that destroys the structure and prevents air and water circulating.

MAXIMISE SOIL FERTILITY

1. Before applying the appropriate inputs, estimate the need for nutrients in the soil by observing plants indicative of low fertility and through laboratory analysis.
2. Avoid all shortages and over-applications of mineral and organic inputs since this favours the development of crop pests (white flies, leaf diseases).
3. Combine mineral inputs with organic inputs (combine forms of nutrient inputs to avoid excess and leaching).

UNDERSTAND SOIL FERTILITY

SOIL NEEDS TO BE TILLED

— Till the soil to avoid the formation of a crust on the surface while preserving more fragile soils.

— Plough only if necessary and to a depth that facilitates root growth.

Tilling the soil gives it a good structure, allowing air and water to circulate. It helps incorporate organic matter, improve water reserves and regulate temperature.

THE PRESENCE OF NUTRIENTS THAT CAN BE ASSIMILATED IS ESSENTIAL

— Keep a balance between nitrogen, phosphorous and potassium.

— It is essential to maintain the presence of other minerals (calcium, magnesium, etc.).

This improves plant stress resistance (a healthy plant is more resistant to diseases) and improves the quantity and quality of yields.

MICRO-ORGANISM ACTIVITY PROMOTES PLANT GROWTH

— Keep a sufficient level of organic matter that can easily be broken down in the soil, through inputs (compost, manures) or burying crop residues.

— Maintain soil aeration (tillage).

This allows micro-organisms to develop and perform essential functions (biodegradation of organic matter, production or absorption of nutrients by plants, breakdown of pollutants, pest protection, etc.).

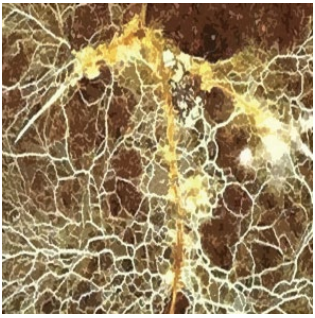
IMPROVE SOIL FERTILITY

CONSERVE SOIL FERTILITY

— Offset nutrients lost by proportionate inputs based on an estimate of nutrient requirements.

— Make rational inputs of high quality mineral and organic manures (avoid KCl).

This ensures the quality and sustainability of the food supply to plants.



FOSTER BENEFICIAL ASSOCIATIONS

— Limit the use of fungicides in the soil in order to foster fungus and microbial life that is beneficial to plants.

— Facilitate the development of fungus and bacteria on the roots.

— Keep plants on land parcels that fix nitrogen from the air (legumes such as beans and peas).

These associations help nutrients be assimilated and contribute to maintaining soil structure quality (thanks to the network of filaments formed by fungi in the soil.).

ADOPT SUSTAINABLE AGRICULTURAL PRACTICES

— Ensure that crops are rotated (succession of different crops on the same land parcel).

— If necessary, include a set-aside period in the rotation.

— Combine several crops on the same parcel.

This makes it possible to take into account the different nutritional needs of plants and to avoid certain diseases. Certain leafy vegetables need a lot of nitrogen and grow best when planted after legumes.

PROTECT SOIL FERTILITY

AVOID SALINISATION OF THE SOIL THROUGH IRRIGATION

— Avoid using indeterminate sources of water (do not use salty or polluted water).

— Adjust and reduce irrigation to the strict minimum.

— Avoid soil erosion as a result of irrigation (use watering systems with sprinkler heads, drip-irrigation systems, etc.).

Repeated use of irrigation water leads to the deposit of salts in the upper layer.

COVER THE SOIL TO AVOID SOIL LOSS THROUGH EROSION

— Maintain plant cover as long as possible.

— Practice agroforestry (planting certain species of tree or bush alongside crops).

This enriches the soil by recovering nutrients at depth through the roots of the trees and the decomposition of dead leaves on the surface.

MAINTAIN THE STABILITY OF THE SOIL STRUCTURE

— Avoid compacting the soil through poor farming practices.

— Limit trampling (by men and cattle).

— Avoid the passage of heavy machinery over land parcels (tractors, harvest trailers, etc.).

This helps conserve good porosity favourable to exchanges between the soil and the air and fosters a good organic-matter transformation process that will benefit plants.

HOW TO OPTIMISE SOIL FERTILITY

ASSESS SOIL QUALITY TO OPTIMISE INPUTS

— Observe plants indicative of low fertility (e.g. *Cyperus amabilis* indicates leaching of clays and the loss organic matter: soil fatigue).

— If necessary, conducts a laboratory analyse of the soil composition.

This makes it possible to identify the elements that are lacking in the soil, to adjust the inputs and avoid over-application that is toxic for the planet and costly for the farmer.

COMPLY WITH THE DOSAGE FOR MANURE

— Avoid over-application of manure by assessing plant needs and the quality of the soil.

— Avoid shortfalls of certain elements (deficiencies).

This limits wastage of manure (mineral and organic) and avoids the accumulation in the soil of certain substances that are harmful in excess (excess nitrogen favours white fly and oidium disease or powdery mildew on leaves).

COMBINE MINERAL AND ORGANIC MANURES

— Opt for the use of chemical fertilisers that provide elements other than just nitrogen, phosphorous and potassium (sulphur, manganese, zinc, etc.).

— Choose organic input forms that reduce leaching (slow mineralisation).

This limits water pollution (streams, rivers, watersheds, etc.) and favours gradual phasing out of minerals for the benefit of cultivated plants.

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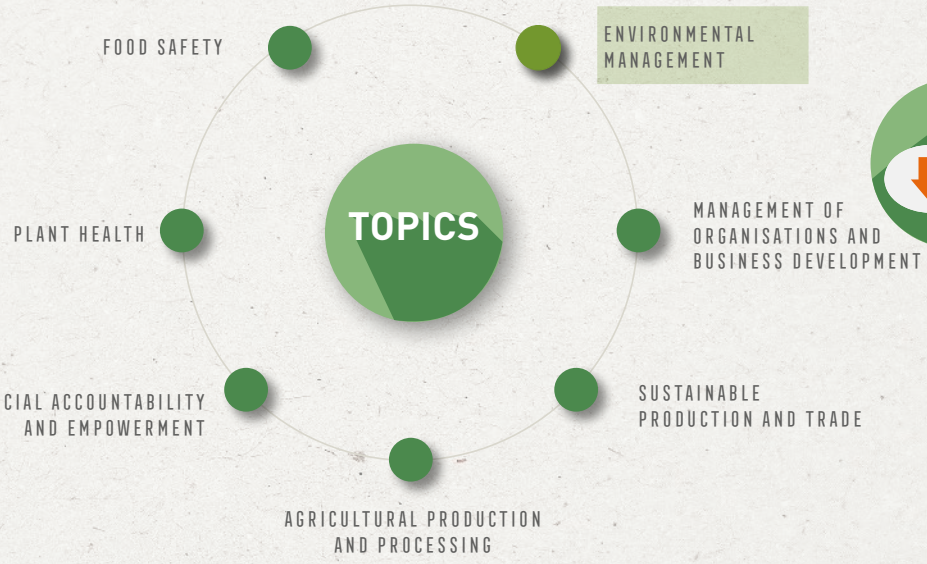

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