

Spotlight on Agriculture

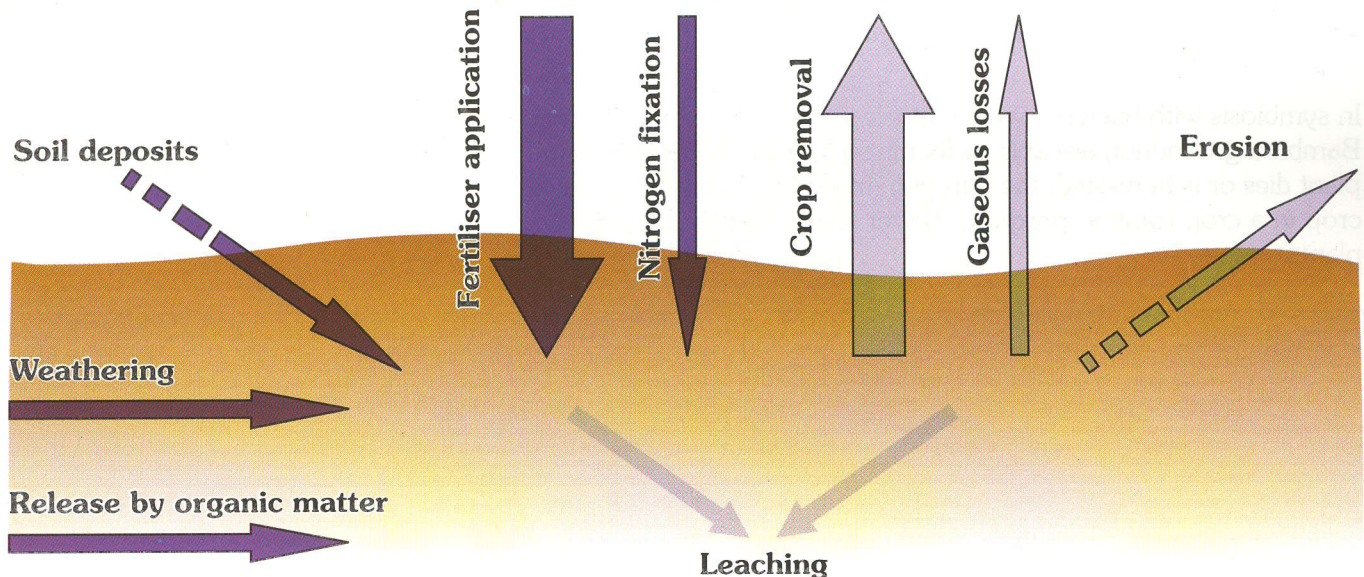
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Soil Fertility Management for Sustained Crop Production

The soils of Namibia's northern communal areas have a low inherent crop production potential. Under these circumstances sustainable food crop production is not only limited by harsh climatic conditions, but also by farmers' inability to replenish the nutrient loss under continuous cultivation that has replaced the traditional bush fallow system or shifting cultivation. Generally the soils are low in organic matter content, available nitrogen and cation (such as Calcium, Magnesium, Potassium) exchange capacity (CEC). Crop production in these inherently poor soils must strongly emphasize on organic inputs and nutrient recycling. The choice of an appropriate nutrient management strategy will also depend on the available resources at the farm.

NUTRIENT BALANCE IN AGRICULTURAL SOILS: TURNOVER OF NUTRIENTS IN THE SOIL-PLANT CYCLE



OPTIONS FOR SOIL FERTILITY IMPROVEMENT

Integrated nutrient management involves the wise use and management of organic and inorganic nutrient sources in ecologically sound production systems. A sustainable crop production system must adopt an ecological approach using balanced nutrient inputs from inorganic, organic and biological sources. These nutrient inputs can be provided in organic-nutrient recycling, biological-nitrogen fixation and inorganic nutrient input.

Organic-Nutrient Recycling

Strategies and practices for soil organic matter management comprise of the return of organic materials to the soil such as the application of animal manure, green manuring, cover cropping, mulching and incorporation of crop residues.

Beneficial effects of an increased soil organic matter are:

- Improved soil structure and increased water holding capacity.
- Increased capacity of the soil to buffer changes in pH.
- Increased cation retention capacity (CEC).
- Reduced phosphate fixation.
- In addition soil organic matter is a reservoir of secondary nutrients and micro-nutrients and is an energy source of soil fauna and micro-organisms, which are the primary agents that manipulate the decomposition and release of mineral nutrients in soil ecosystems.

Biological-Nitrogen Fixation

The use of nitrogen fixing leguminous crops as green manure, cover crops, in a cereal-legume inter-cropping or crop rotation can increase the availability of soil nitrogen, especially when legume residues are incorporated in the soil. See Pictures 1 and 2 from a crop rotation trial at Mahanene Research Station during March 2001.



Picture 1. Monocropping Millet, no input



Picture 2. Crop rotation Millet: Cowpea 1:1, with inputs

In symbiosis with bacteria, which attach to their roots, plants of most leguminous species (e.g. cowpeas and Bambara groundnut) are able to fix nitrogen from the air and use it for their own growth. When the legume plant dies or is harvested, the nitrogen fixed in the roots becomes available in the soil for use by the following crop in a crop rotation program. Better results can be achieved by also incorporating the green parts of the plants.

Leguminous crops therefore:

- Enrich the soil with biologically fixed Nitrogen.
- Improve soil structure through a predominant tap root system.
- Conserve and recycle soil mineral nutrients if residues are returned to the soil.
- Provide ground cover to minimise soil erosion.

Chemical Fertiliser-nutrient Input

Fertilisers are inorganic materials of a concentrated nature. They are applied mainly to increase the supply of one or more of the essential nutrients, e.g. NPK. They also contain these elements in the form of soluble or readily available chemical compounds, which in most cases are relatively quickly available for the plant.

Inorganic fertiliser is needed in intensive and maximum production oriented agriculture, where the nutrient balance in the soil can not be maintained with the input of organic fertilisers alone. Inorganic fertilisers must always be used in combination with management practices that help maintain soil organic matter, such as the return of residues or manure to the soil.

Reference: Mengel K. and E. A. Kirkby (1987). Principles of plant nutrition. International Potash Institute Bern, Switzerland 1987.
Joji Arihara (2000). Cropping Systems and their Mechanisms of Nutrient Uptake. <http://www.agnet.org/library/article/eb491.html>

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