

4. Enhancing soil productivity with agrominerals.

Many of the problems of tropical agriculture originate in the nature of soils (Sanchez 1976). Tropical soils commonly have inherently low fertilities. They have been exposed to long periods of weathering, which results in highly depleted soils with low organic matter, low cation exchange capacities, and an overall low inherent fertility. Common tropical soils, such as oxisols and ultisols, are acid, and have low N and P status. Over-cropping and/or inappropriate use of fertilizers can accentuate the soil related problems and can result in poor soil productivity and low crop yields.

Existing agromineral resource inventories have been compiled in many countries, but have concentrated mainly on large deposits. There are however many more deposits in the world that have not been developed, most of them being of medium to small size.

The best known agrominerals are:

- saltpeter, the only naturally occurring nitrate mineral that occurs in sizable deposits,
- phosphate rocks (PRs) with apatite as the principle phosphate mineral,
- guano minerals, complex P- and N-bearing compounds,
- potash, mainly sylvite (KCl), and complex K-bearing salts,
- K-silicates, such as K-micas, glauconites, and K-bearing volcanic rocks and K-zeolites,
- sulphur, sulphides (e.g. pyrite) and sulphates (e.g. gypsum),
- calcium and magnesium carbonates,
- various silicate minerals and rocks used to conserve nutrients (e.g. zeolite) or used to conserve soil moisture (e.g. scoria and pumice).

Rocks and minerals are used in crop production systems for several purposes, among them:

- improving soil fertility,
- correcting the pH of soil,
- conserving nutrients and water.

At present, the main nutrient limiting factors in sub-Saharan Africa soils are nitrogen (N) and phosphorus (P). While nitrogen can be introduced to the soil through various organic inputs, including manures, plant and tree prunings, and leguminous mulches, there is no equivalent process to nitrogen fixation for the introduction of P into the farming system. Phosphorus can be supplied in small amounts through organic residues and by-products, but the amount is generally insufficient to meet crop demand (Palm 1995; Sanchez and Palm 1996). Phosphorus must be added to the depleted soils in a concentrated form, either as P-containing fertilizers or locally available phosphate rocks.