1. Definition: The main principles of IPNM are to maximize the use of organic inputs while minimizing nutrient losses and to make supplementary use of fertilizer. It adopts a holistic view of plant nutrient management by considering the totality of the farm resources that can be used as plant nutrients.

2. Background: During the last 30 years an average of 660 kg N/hectare and 75 kg P/hectare have been lost from agricultural soils in Sub-Saharan Africa. Major losses occur through export with harvest products and soil erosion. Fertilizers compensate only 18% of the lost nitrogen. Loss of nutrients has serious consequences in many developing countries as the agricultural sector typically account for more than 50% of the Gross Domestic Product. Major economic effects of reduced soil fertility are:
- lower return on agricultural investments
- increased need for famine relief
- higher food prices
- increased government expenditures on health
- reduced government revenue due to less taxes collected on agricultural goods
- migration to urban areas
- increased sedimentation of dams due to soil erosion

3. Good practices for IPNM. Good practices for IPNM often involve a combination of organic and inorganic sources of nutrients. Organic materials are of particular importance to maintain and improve the quality of the soil, whereas fertilizers are often needed if production is to increase. Types of organic sources of nutrients are crop residues, fixed nitrogen, farm yard manure, household waste and mulches. Organic sources of nutrients can be low cost sources. Limitations to their use are low availability of phosphorus, high labour demand and nutrient release not well synchronized with crop uptake. In addition, the availability of plant nutrients are often insufficient to meet crop demand. Even in countries with high livestock densities, farm yard manure is not available in sufficient quantities.

Use of fertilizer can be economically attractive when the value cost ratio for fertilizer is above 2. Value cost ratio is calculated as the value of the yield increase due to fertilizers divided by the cost of using fertilizers. If there is high risk involved in using fertilizer as in drylands, this ratio should be above 3.

Supply of phosphorus is often critical, as supply of this nutrient is particularly dependent on the use of inorganic sources.

Adoption of IPNM technologies is linked to an enabling socio-economic environment. This includes improving market for agricultural products and rural infrastructure, ensuring competition among dealers of agricultural inputs and outputs, and access to credit. It is furthermore important to promote agricultural extension on IPNM and involve farmers in technology generation at an early stage.

IPNM technology should in general be:
- productive and conservation effective
- low labour requirements
- low cost
- simple to understand
- easy to maintain
- low risk

There exists no fixed recommendations with regard to choice of IPNM technology as this depends on market situation, price ratio of inputs and output, availability of inputs, alternative use of organic material, labour cost, farmer’s knowledge base etc. Local adaptation is always necessary. However, the following guiding principles can be of use:

Principle 1. Maximize the use of organic material
- Maximize the return of crop residues to the soil
- Include nitrogen fixing legumes in the rotation
- Apply organic material produced off-field whenever possible
- Address the problem of transport of organic materials
- Improve the integration between crop and livestock production to increase the availability of farm yard manure
- Improve the quality of farm manure by upgrading the fodder quality

Principle 2. Ensure access to inorganic fertilizer and improve the efficiency of its use:
- Combine inorganic fertilizer with organic materials to maintain/improve soil quality
- Improve the efficiency of fertilizer use (kg grain produced per kg fertilizer applied) by making use of techniques such as hill application of fertilizer (appropriate for pearl millet and sorghum), split application,
The arguments in favour of fertilizer subsidies are that:

- Natural resource management and environmental policy
- Please contact Noragric for further information.

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Appropriate timing of application, use fertilizer responsive varieties, adjust quantities used according to climatic conditions, water harvesting/irrigation, weed and pest control etc.

- Make fertilizer available in packages appropriate for small scale farmers
- Train dealers of fertilizer on quality issues, handling and marketing

**Principle 3. Minimize loss of plant nutrients**

- Increase soil cover by increasing crop growth (principle 1 and 2), apply surface mulches or change to perennial crops
- Ensure an early establishment of the crop by modifying farming practices
- Change soil slope by using contour bunds made of stone, earth, crop residues or live vegetation
- Apply minimum or zero tillage whenever appropriate
- Reduce excess water entering fields by proper management of adjacent grazing/forest land

Continuous technology generation as well as socio-economic research on factors governing adoption of IPNM are also necessary ingredients for a successful IPNM programme.

**Fertilizer subsidies?**

Following structural adjustment and subsidy removal - fertilizer use has declined precipitously in many countries. A heated debate about the merits of fertilizer subsidies has ensued.

Arguments against are that:

- Fertilizer subsidies have high budgetary cost.
- Subsidies may distort the relative profitability of different inputs and crops.
- Fertilizer subsidies have often been used in situations when supplies have been rationed. They have then failed to increase consumption of the input, and only represented an income transfer to some favoured farmers.
- When subsidies have been paid only to the parastatal fertilizer distributor, they have also prevented the development of a competitive fertilizer marketing system.
- Fertilizer subsidies may be used as an excuse for depressing producer prices of agricultural goods.
- There may be cheaper means to increasing fertilizer use than subsidies: e.g. better regulatory framework for marketing, improved transport infrastructure, improved extension and applied research, improved financial markets.

The arguments in favour of fertilizer subsidies are that:

- In developing countries increased fertilizer use may be environmentally benign in reversing the current net nutrient depletion; increasing plant cover on cultivated land (thereby reducing erosion); and increasing yields, thereby reducing the demand for new land for cultivation (leaving more land for nature).
- Widespread market failures especially in credit markets may induce socially under-optimal use of purchased farm inputs.
- Subsidies may be required for stimulating sufficient fertilizer demand for the marketing of the input to benefit from economies of scale (thereby escaping from an “evil circle” of low demand and high prices.)
- If the alternative is to provide large amounts of food aid even in “normal years”, assisting poor countries in using sufficient fertilizer to assure food self sufficiency seems to be a superior option – both in terms of budgetary cost, equity concerns and development impacts.
- Limited recipient institutional capacity may sometimes be a constraint to aid to agriculture.

On balance, there seems to be a case for donors to support fertilizer subsidies, especially in countries where current use is very limited and where limited recipient institutional capacity may be a constraint to other types of aid to the rural sector. Net cost to the government may be less than the budgeted subsidy if increased agricultural production yields increased government tax revenue.

Such a subsidy should be viewed as a short-term policy while investments are made in measures that may yield long term effects (e.g. infrastructure development, improved market regulations, improved rural education, agricultural research and extension, improved financial markets.)

If fertilizers are subsidized, the subsidies must be given in a way that does not increase the risk faced by fertilizer distributors, nor distort competition between dealers. Furthermore, when the objective is to increase fertilizer use, the rate of subsidy must be the same for imports and domestically produced fertilizer. A system where subsidies are paid to fertilizer importers based on border controls and to fertilizer manufacturers on the basis of documented sales to wholesalers, should be relatively easy to manage. (It would, however, not be entirely secure against fraud.) Under such a system, donor support could be given as an earmarked contribution to the recipient country government budget.

It may be seen as desirable to target fertilizer subsidies to some farmers only, e.g. by rationing the amount available to any individual farmer, or linking the subsidy to the use of other inputs or credit, or demanding that farmers have implemented conservation measures. Such targeting schemes will be vastly more demanding of administrative capacity and competence than a system where the subsidy is paid to importers and manufacturers at a fixed rate.

This is a summary of the report “Integrated Plant Nutrient Management (IPNM)”, 1998.
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Noragric aims to promote equitable development and community empowerment in low-income countries and countries with an economy in transition, through generating and disseminating knowledge in the areas of sustainable agriculture, food security, natural resource management and environmental policy.
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