

Efficient use of nutrients

To produce the basic demand of food, feed, fibre, fuel and raw materials from about 0.14 ha land per world citizen is the most important challenge of our time. Mr. Angé and Mr. Roy describe FAO's Integrated Plant Nutrition Systems (IPNS) aimed to balance production and conservation.

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Agriculture is far from sustainable in many parts of the world due to many reasons. One reason can occur when plant nutrients exported from the fields or from community territories exceed the natural replenishment plus applied nutrients from outside the same fields or territories. While the use of mineral fertilizers is the quickest and surest way of boosting crop production, their increased costs (by reduction or withdrawal of subsidies) without correspondingly enhancing producer prices and other constraints frequently deter farmers from using them in recommended and balanced quantities. The basic concept of Integrated Plant Nutrition Systems (IPNS) is the maintenance or adjustment of plant nutrient supply at an optimal level for sustaining the desired crop productivity through the optimization of the benefits from all possible sources of plant nutrients in an integrated manner.

Plant nutrient supply to the soil/crop system results from the sum of the supply from independent renewable sources (rain, N-fixation, soil weathering and deepening), from the recycling of wastes and by-products generated by the farming systems (dependent and renewable resources), and from the mining of non-renewable sources (soil reserves, mineral fertilizers).

Sources of nutrients

Plant nutrition management should not be conceived in terms of balance sheets of overall figures only but also in terms of timely availability of nutrients for crops. Crops require a higher instant flow of nutrients at specific growing stages if higher yields are expected. Organic sources release these nutrients slowly in general. The cropping system rather than an individual crop, and the farming system rather than an individual field, are the focus of attention. IPNS identify the best associations of various types of nutrients in the different fields for a balanced plant nutrition and a given level of yield, at the same time sustaining soil fertility and controlling nutrient losses.

In-situ recycling of crop residues will bring back a certain amount of nutrients to the same field but they are not new sources

of nutrients. In-situ growing of leguminous trees and their biomass incorporation will bring atmospheric nitrogen into the system, and occasionally, through their deep roots, nutrients leached beyond root zone and sub-soil mineralized nutrients are brought to the surface layer for the use of annual crops. When biomass is brought from outside the plot or farm and/or cattle grazing on uncultivated land, it is basically a transfer of nutrients from one place to another.

Thus these techniques transfer plant nutrients and contribute to plant nutrient export. They are sustainable if they conserve positive plant nutrient balance sheets in the overall area in which they are developed.

Contrary to the Low External Input (LEI) and Organic Farming approaches, IPNS does not restrict its activities to low crop productivity and takes account of the overall plant nutrient cycle. Necessary plant nutrient supply is identified according to the targeted yield. The role of local plant nutrient sources and that of external inputs have to be decided according to the availability of local resources and to their capacity to cover the requirements for the targeted yields and for all types of plant nutrients. External inputs are, in most cases, the only source for the replenishment or for the increase of the working capital of plant nutrients in the farming system.

The IPNS programme of FAO upgrades the productivity of all sources of plant nutrients and reduces plant nutrient losses. If the fertility of the soil and the plant nutrient content of the soil/crop system

have already been lowered to a high degree by inappropriate practices, one major task of IPNS will be at least to stop the unfavourable ongoing evolution. This needs better understanding of the constraints and of the efficiency of practices required to rebuild more productive systems than through the simple recycling of organic materials. The role of mineral fertilizers must be clearly defined within the range of practices needed to increase their efficiency and within the complete cycle of plant nutrients within the soil/crop system.

Farmers develop IPNS

The agro-technical concept of IPNS has been enlarged to a development programme promoting natural resource management through people's participation.

In a series of technical cooperation projects in for example India, Indonesia, Laos, Nepal, Pakistan and Thailand long-term field trials have been set up a few years ago to feed practical data into the IPNS concept. IPNS need to be implemented at farm level or even at village level. At farm level, possible alternatives identified at plot level are to be integrated according to the production goals of the farmer and to general availability of resources, to ensure the highest benefits and higher labour efficiency. In many areas, the IPNS approach must be practised at village level because the resources used to sustain the system are available at village level too, e.g. litter from surrounding forests, relationships between pastures and cultivated areas through e.g. manure use, collective use of residues by cattle after harvest.

A shift in extension approach

The development of IPNS includes a major modification of mainstream extension practices, as IPNS cannot be developed with blanket recommendations. In the new line of thinking extension services should rely on a panel of alternative proposals, for which all necessary conditions of efficiency are identified in reference farms, representative for socio-economic and ecological conditions in the region. The IPNS programme needs well-established collaboration with national and international institutions, and with active NGOs on the matter to ensure common action on people's participation in designing plant nutrient management. One example is the collaboration initiated with NGOs in Bolivia, implemented with the Extension Service since January 1993.

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OUR VIEW

In most developing countries where the natural resource base has already become seriously depleted, organic farming is not a solution by itself to meet their increasing demand for food. Organic farming requires major labour investment when agricultural tools and energy are not available. To improve the soil and labour productivity and sustain them at a reasonable level, complementary use of a certain amount of mineral fertilizers and local sources of plant nutrients would be essential. The efficiency of plant nutrients has to be increased and their losses in cropping systems limited.