

8. Integrated Plant Nutrition System (IPNS)

8.1 Concept

The basic concept of Integrated Plant Nutrition System (IPNS) is ‘the management of all available plant nutrient sources, organic and inorganic, to provide optimum and sustainable crop production conditions within the prevailing farming system’.

Therefore, in IPNS an appropriate combination of mineral fertilizers, organic manures, crop residues, compost, N-fixing crops and bio-fertilizers is used according to the local ecological conditions, land use systems and the individual farmer’s social and economical conditions.

When you advise the farmer on how best to follow an IPNS approach, it is important to look at *the cropping pattern* rather than a single crop, and *the whole farming system* rather than the individual field. Before establishing the need for mineral fertilizers, it should be estimated what is available and what is the plan nutrient value of FYM, crop residues, compost and other organic material. Only then should you try to complement the shortfall in required plant nutrients with inorganic fertilizers. When you have prepared a balanced fertilizer plan for the farmer, remember again to discuss proper crop rotation, encourage crop diversification, and the use of the green manure like dhaincha and the use of BNF, where suitable.

Many cropping patterns are practiced in Bangladesh depending on the agro ecological conditions and availability of irrigation facilities. These cropping patterns are essentially rice-based, since rice is grown in most areas at least once in the pattern.

8.2 Elements of IPNS

The following elements in IPNS can be considered.

Natural resources: Soil supply, water supply (irrigation), deposition by rain or dust and natural BNF.

Organic nutrient sources

- Crop residues are important for recycling of a good percentage of nutrients taken up by the plant, which are gradually returned to the soil. Besides, it will also apply organic matter to the soil.
- Green manure increases the working capital of nutrients by nutrient mobilization (by taking up nutrients from the soil and making them available to the following crop through decomposition, N-fixation or by saving nutrients from leaching). Organic material will be added to the soil as incorporation of green manure.
- Nitrogen fixation by bacteria and other microorganisms through biofertilizers is an important source for non-inorganic nitrogen supply to the cropping system.

- Organic matter management

Preservation and application of organic matter from manures (e.g. cowdung, poultry manure, FYM) or compost (e.g. water hyacinth). Important criteria of organic matter sources are the dry matter content, total and quick-acting nitrogen, C/N ratio, etc.

- Organic waste management

Other organic wastes can also be considered for supplying plant nutrients and/or organic matter, e.g. pressmud from sugarcane, oilcakes, etc. Night soil or (treated) sewage sludge is already in use in some countries, although care should be taken in terms of hygiene and crop and soil quality (polluting agents).

Mineral resources: Inorganic fertilizers.

8.3 IPNS approach in the Soil Fertility and Fertilizer Management Project (SFFP) activities

IPNS is the main strategy through which SFFP tries to achieve its objective of “Food grain production increased through maintenance and improvement of soil fertility”. The following SFFP field activities implemented through DAE in the upazilas are in this respect most relevant: Cropping Pattern based balanced fertilizer demonstrations; Biological Nitrogen Fixation (BNF) demonstrations; Green Manure demonstrations introducing “dhaincha” as green manure in cropping systems; Preservation and use of (FYM). In Block Demonstrations it is tried to transfer IPNS to groups of farmers for increased and sustainable yields in cropping systems using above mentioned accepted and transferable technologies. In Trainings and Workshops to DAE staff and farmers emphasis is laid on interaction and integration of plant nutrients from different sources in cropping systems for increased and sustainable yields. The respective Research Institutes (BARI, BRRI, BJRI, BINA, BSRI, and BAU) are investigating the most suitable, efficient and environmentally and socially acceptable methods of Integrated Nutrient Management.

8.4 Computation of IPNS

Under farmers’ condition in the field the following approach in relation to relevant IPNS procedures might be suggested.

First an assessment should be made of the possible plant nutrient and organic matter sources available within the farming system. Then it should be established what the approximate plant nutrient contribution of these sources is (nutrient content, nutrient release). Some assessment of the soil fertility status in the field can be made, using the information available with the farmer from his own field plus possible soil sample for additional information. It can be helpful to have an idea about the soil nutrient supply capacity by knowing the natural or biological yield of a certain crop (yield without fertilization).

Together with the farmer a realistic yield target should be set, taking into account his resources, possible risks, etc. Then the question remains how best to complement the shortfall between targeted plant nutrient demand by the crop and the approximate organic plant nutrient supply, with

Table 5. Computation of IPNS based fertilizer requirement for Potato-T. aus-T. aman rice cropping pattern

Step 1: Nutrient recommendation in kg/ha (from AEZ tables) for Potato-T. aus-T. aman rice cropping pattern

AEZ : 19 Land type : Medium High Land Rainfed/Irrigated: Irrigated

Season	Crop	Yield level (t/ha)	N	P	K	S	Mg	Zn	B
1. Rabi	Potato	25.00	96	16	80	8	-	1	0.5
2. Kharif-1	T. aus	3.50	50	4	10	5	-	-	
3. Kharif-2	T. aman	4.00	60	4	18	5	-	1	

Step 1a. Fertilizer plan for potato :

			N	P	K	S	Mg	Zn	B
a) Recommended dose (kg/ha)			96	16	80	8	-	1	0.5
b) Supply from organic material	Cowdung	5 t/ha	15	5	15	-	-	-	
c) To add from fertilizer (a-b)			81	11	65	8	-	1	0.5

Step 1b. Fertilizer plan for T. Aus rice

			N	P	K	S	Mg	Zn	B
a) Recommended dose (kg/ha)			50	4	10	5	-	-	-
b) Supply from organic material	None								
c) To add from fertilizer (a-b)			50	4	10	5	-	-	-

Step 1c. Fertilizer plan for T. Aman rice:

			N	P	K	S	Mg	Zn	B
a) Recommended dose (kg/ha)			60	4	18	5	-	1	-
b) Supply from organic material	None								
c) To add from fertilizer (a-b)			60	4	18	5	-	1	-

Step 2. Nutrients converted into fertilizer materials in kg/ha:

Material	Urea	DAP	SSP	TSP	MOP	Gypsum	Mg Sulphate	Zinc Sulphate	Boric acid
1. Rabi	180			80	160	44		3.0	
2. Kharif-1	110			20	20	28		-	
3. Kharif-2	133			20	36	28		3.0	