

4. Crop response to added nutrients and fertilizer recommendations

4.1 Biological response

Response of a crop to added nutrients depends on soil-crop-climatic variables and production practices. In general, most of the soils and crops are responsive to N fertilizers. Upland and rabi crops grown under strongly acidic and alkaline soil conditions are more responsive to P fertilizers. Oil seed crops and wetland rice are responsive to S fertilizers. Sugarcane and tuber crops are more responsive to K fertilizers. Crops grown on light textured soils respond more to K fertilizers. Crops grown on the calcareous and saline soils respond more to Zn fertilizers. Fertilizer response is more pronounced under irrigated than under rainfed ecosystems. Crops may differ markedly in their requirements of different nutrients. Again soil moisture content may affect the response of a crop to fertilizers. Furthermore, fertilizer response of a crop depends on the kinds of fertilizers used, and also on the time and methods of their application.

From the field trials conducted by OFRD(BARI), it appeared that the average grain yield of two rice crops was 5.0 t/ha/yr without any added fertilizers or manures (Fig. 7), and the yield increased to above 10 t/ha/yr when nutrients were added on HYG basis from both inorganic and organic sources (IPNS). About 9 t/ha/yr yield was obtained from farmers' practice of fertilizer use.

The response of a crop to added nutrients shows a well-defined pattern. When any growth parameter or yield of a crop is plotted as a function of increasing amounts of applied nutrients, successive increments of nutrients give successively smaller increases in crop growth or yield. Such curves are known as growth response curves. From the response function equation the value of an added nutrient that maximizes yield is estimated as follows:

$$\hat{Y} = a + bx + cx^2$$

where Y is the maximum crop growth or yield
a, b and c are co-efficients and
X is added nutrient

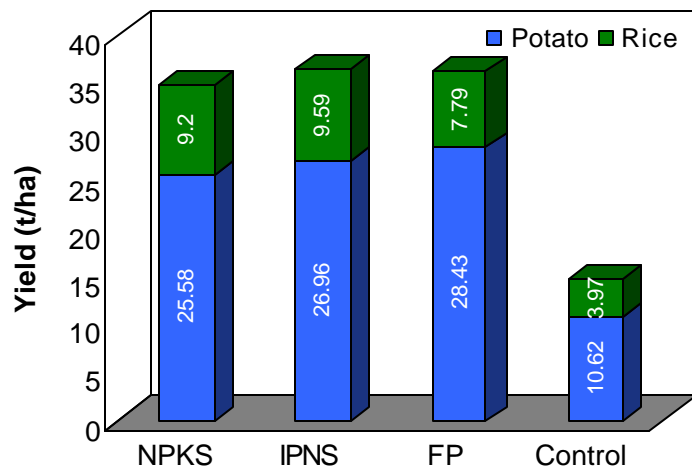
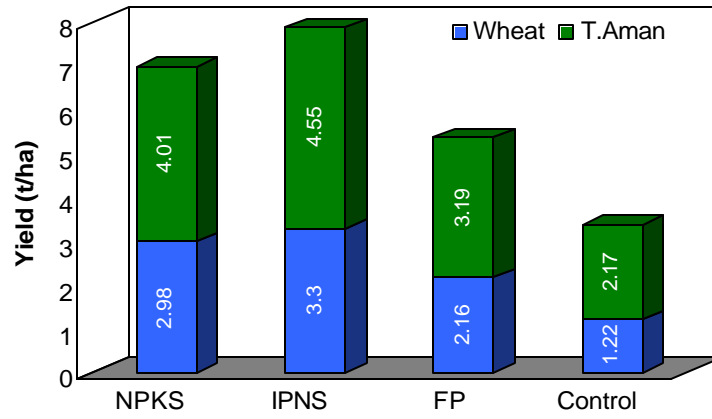
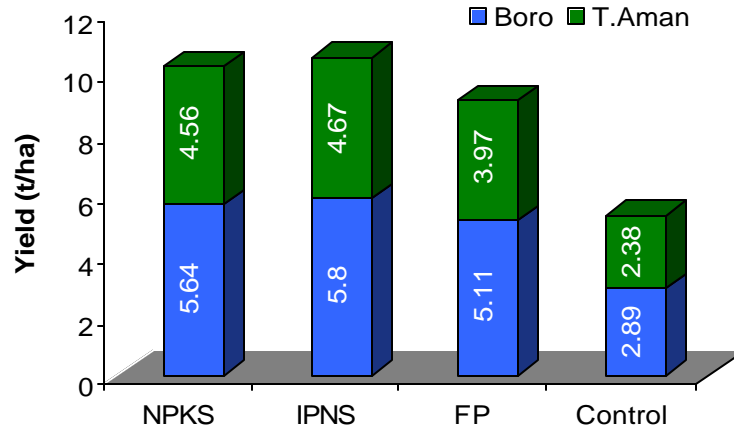
The optimum nutrient rate (N_y) can be computed from the above equation as

$$N_y = \frac{-b}{2c}$$

Now, the nutrient rate that maximizes profit:

$$N_p = \frac{1}{2c} \left(\frac{P_f}{P_y} - b \right)$$

Where, P_f = Price of nutrient and P_y = price of crop product



Nutrient packages

Fig. 7 Yield of crops grown in different sequences as influenced by different nutrient management packages

4.2 Socio-economic aspects on the use of balanced fertilizers

AEZ based balanced fertilizer management refers to a blanket dose of fertilizers for a particular area (AEZ) based on crop requirement and soil fertility status. These recommendations are based on fertilizer response to different crops, costs of fertilizers and outputs. During SFFP surveys it was evident that, some SFFP demonstration farmers deviate from the use of AEZ based recommended dose of balanced fertilizers (little higher or lower) on consideration of the soil fertility condition for a specific plot within the AEZ. However, the following socio-economic factors may be considered for making local recommendations of the balanced fertilizers for different crops/cropping patterns.

Socio-economic factors	socio-economic issues should be considered in local level fertilizer recommendation
Farm size	<ul style="list-style-type: none"> • Marginal and small farmers having no other alternative sources of cash money may not be able to use balanced doses of fertilizers. • For medium and large farmers it may be easier to invest more money for use of balanced doses of fertilizers.
Credit facilities	Lack of institutional sources of credit facilities sometimes hamper the use of balanced doses of fertilizers.
Share cropping	In this system of cultivation the tenant farmers will not be willing to use balanced doses of fertilizers unless the landlord shares the cost of fertilizers in proportion to his output sharing with the tenant farmers.
Change of price of fertilizers	If the fertilizer prices increase farmers may use less or imbalanced fertilizers.
Change of price of outputs	If the price of output falls down farmers are not willing to use proper doses of fertilizers to avert the risk of investment.
Lack of knowledge on balanced fertilizers and IPNS	<ul style="list-style-type: none"> • Lack of knowledge on the advantage of using balanced fertilizers may result in imbalanced use of fertilizers by the farmers. • Farmers do not know how much chemical fertilizer is to be reduced while organic matter is added in the soils to make it a balanced dose of fertilizer.
Lack of motivation	Though some farmers may know that use of balanced fertilizers could improve their soil fertility and output due to lack of proper motivation they do not use it.