Development of Fertilizer Recommendation in Bangladesh

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Yield of Boro (BRRI dhan 29) in Tangail

Grain yield of maize (Pacific 11) in Pabna

Grain yield of mustard (Tori 7) in Bogra
Nutrient Recommendation/Management

Why?

What Source, Rate?
How to apply?
When to apply?
Where to apply?
What approach?

Crop Demand
Soil demand
Farmers ability
Emergence of nutrient deficiencies on time scale in Bangladesh
• Genesis of fertilizer recommendation in Bangladesh
• Major features of FRG 2005
• Areas for further improvement
Genesis of fertilizer recommendation in Bangladesh

- Early period
- Pakistan Period
- Bangladesh Period
Early period

1911 - 1953

• Period of use of organic manure
  1911-23 → 1944

• Shifted from organic manure to organic + Inorganic
  1944 → 1954
Results & Recommendation

- Application of organic manures improved the soil fertility and thereby increased the yields of the paddy
- Mustard oilcake and fish meal proved superior to other organic manures
- Among the chemical fertilizers the effect of ammonium sulphate was found distinct and prominent in increasing the yield of paddy
Pakistan Period

• Farmers acquainted with chemical fertilizers and encouraged to use them along with organic manures.

• Chemical fertilizer use in East Pakistan began in 1951 with the import of ammonium sulphate

• The use of urea and TSP was introduced in 1957-58

• Murate of Potash (MP) was added to fertilizer schedule from 1960
During early sixties soils are broadly classified & nutrient status was analyzed
Based on soil nutrient status and fertilizer trials conducted it was found necessary that different fertilizer combinations were required for different soil tracts.

Fertilizer Recommendations for different crops and different soil tracts were formulated.

Recommendation published in 1961 under the caption “FERTILIZER USE IN EAST PAKISTAN”
Reconnaissance surveys carried out during 1961-70
Fertilizer Recommendations for general soil types were published in 1967 entitled “Soil Fertility Investigation in East Pakistan” the seemed Fertilizer Recommendation Guide 1967

Fertilizer Recommendation Guide 1967 was revised in 1969 entitled “Studies on Fertilizer and Soils of East Pakistan”
Bangladesh Period

Fertilizer Recommendations for different soil types were made in 1976.

FAO/UNDP Fertilizer Demonstration and Distribution Project, during 1975-80 conducted on-farm trials & demonstrations mainly on local/local improved varieties of crops on single crop basis.

• Trials and demonstrations continued during 1980-83 with the assistance of UNDP to develop and verify soil and location specific fertilizer recommendations for HYV of different crops but still continued with approach of single crop based fertilizer recommendation.


Soil and Fertilizer Management was based on soil testing and yield goals.
The efforts continued during 1983-86 with change in approach from single crop based fertilizer recommendation to cropping systems based soil fertility and fertilizer management.

Using AEZ information the fertilizer guide of 1985 was revised and published in 1989.

The guide contains two parts:

i) based on AEZ information cropping systems based soil fertility and fertilizer management and

ii) soil analysis basis recommendation for single crop.
Under the financial assistance from DANIDA, the SFFP started its activities as a follow up to previous the FAO supported Fertilizer project.

The guide of 1989 was further revised with incorporation of SFFP contribution and published in 1997.

It recommends fertilizer application for four soil fertility levels for both high and moderate yield goals.
To Update FRG’97, EC, BARC formed 11 member editorial committee

The committee collected & reviewed updated research & extension information and presented in a national workshop

4 member compilation committee drafted and BARC placed it to NATC for approval
**Major factors considered for fertilizer recommendations:**

<table>
<thead>
<tr>
<th>Diversity of agro-ecological regions</th>
<th>Soil nutrient levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major cropping patterns</td>
<td>Crop response to added nutrient and management</td>
</tr>
<tr>
<td>Land type</td>
<td>Calcareous/non calcareous/red soils</td>
</tr>
<tr>
<td>Soil texture</td>
<td>Rainfed/irrigated condition</td>
</tr>
<tr>
<td>Soil pH</td>
<td>Rationale of fertilizer application</td>
</tr>
<tr>
<td>Soil organic matter status</td>
<td>Resource base of farmers and yield goals</td>
</tr>
</tbody>
</table>
Content of FRG’97 Updated

• Updated recommendation of fertilizers for different crops based on varieties and yield target

• Changing crops and cropping patterns

• Soil nutrient status of different AEZs

• Critical limit of nutrients

• Rationale of fertilizer application
For rainfed condition, all the recommended fertilizer nutrients (i.e. N, P, K, S, etc.) should be reduced by 25-30% in comparison with irrigated condition.

In rainfed condition, the yield reduction would be 15% for rice & jute, 20% for potato & sugarcane, and 35% reduction for wheat, tobacco, oilseed, vegetables and spices.

Rabi season crops should be considered as the first crop of the cropping pattern.
Each crop of a cropping pattern needs to be supplied with N fertilizer as per requirement. In a crop following a good green manuring crop, N fertilizer dose may be reduced by 25-30 kg/ha provided 12-15 tons green biomass of GM (dhaincha) can be incorporated, and following grain legumes, dose of N may be reduced by 8-10 kg/ha.

**P-rates in the second and third crops of the pattern**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percent of the recommended doses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderately acidic to slightly alkaline</td>
</tr>
<tr>
<td>Rice</td>
<td>50-60</td>
</tr>
<tr>
<td>Jute</td>
<td></td>
</tr>
<tr>
<td>Maize, vegetables, spices &amp; pulses</td>
<td>60-70</td>
</tr>
</tbody>
</table>
About 30-40% of K can be reduced in the subsequent crops after potato, maize, tobacco, sugarcane, vegetables and spices where high doses of K fertilizer are generally used.

K dose may be reduced by 20-40% in subsequent crops if 2-4 tons of crop residues/rice straw per hectare are properly recycled with soils.

Potassium application may be reduced by about 10-15% of recommended dose of Kharif season crops.
Crops grown under wetland condition should receive full dose of S. Upland crops (except oil seed crops, maize, vegetables & spices) following wet condition (Kharif season) may receive 50% of the recommended S dose in rabi season. For those exceptional crops full dose of S application is recommended.
Zinc fertilizer should be applied
to both rabi & kharif crops when grown in calcareous

For 2 or 3 rice-rice cropping patterns, full amount of Zn need to be applied to the first crop and 50% rate to the 2\textsuperscript{nd} or 3\textsuperscript{rd} crop

In non-rice-rice pattern (except maize, potato, vegetable & spices) Zn should be applied to rice only

For growing maize, potato, vegetable & spices, Zn need to be applied to a full rate
New content included in FRG 2005

• Nutrient balance
• Liming of acid soils
• Increasing nutrient use efficiency with an emphasis on deep placement of nitrogen
• Soil and fertilizer management based on IPNS concept
• Fertilizer management in multiple cropping systems
• Fertilizer management in crops under no/minimum tillage system
• Fertilizer management in problem soils (saline, peat, acid sulphate and charlands)

• Fertilizer management in hill farming

• Fertilizer management in risk environment

• Quality control of fertilizers

• Maintenance of organic matter in soils
Input > Output: Nutrient build-up
(Pollution in extreme cases)
Input < Output: Nutrient depletion (mining)
Input = Output: Sustainable system
Integrated Plant Nutrition System (IPNS) Approach

IPNS

The management of all available plant nutrient sources to provide optimum and sustainable crop production conditions within the prevailing farming system.
Fig. 1: Fertilizer sales by nutrients by year
<table>
<thead>
<tr>
<th>Year</th>
<th>Use ratio N : P : K</th>
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</thead>
<tbody>
<tr>
<td>1970</td>
<td>11 : 2 : 1</td>
</tr>
<tr>
<td>1975</td>
<td>13 : 2 : 1</td>
</tr>
<tr>
<td>1980</td>
<td>12 : 2 : 1</td>
</tr>
<tr>
<td>1985</td>
<td>12 : 2 : 1</td>
</tr>
<tr>
<td>1990</td>
<td>8 : 1.5 : 1</td>
</tr>
<tr>
<td>1995</td>
<td>12 : 1 : 1</td>
</tr>
<tr>
<td>2000</td>
<td>8 : 0.8 : 1</td>
</tr>
<tr>
<td>2005</td>
<td>9 : 1 : 1</td>
</tr>
<tr>
<td>Desirable uptake ratio</td>
<td>5 : 1 : 4</td>
</tr>
</tbody>
</table>
Nitrogen Use Efficiency is low

Deep Placement of Urea Granules as an Option for Increasing Nitrogen Use Efficiency

Losses

- 34% Plant
- 33% Soil

Negative economic impact
Negative environmental impact
Its application in the field...

• Amount adjusted to the recom. N dose
• 8-10 cm depth
• Within one week of transplanting

Recommended # of balls should be applied at 6-10 cm apart from plant base and into 6-8 cm deep as ring method at 10-15 DAT
## Recommendation

<table>
<thead>
<tr>
<th>Crop</th>
<th>Dose of USG (kg ha⁻¹)</th>
<th>No. of ball/ plant (g)</th>
<th>Application method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>370</td>
<td>10</td>
<td>Fertilizer should be applied 9-10 cm apart from base of plant &amp; 7-8 cm deep as ring method</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>220</td>
<td>8</td>
<td>Fertilizer should be applied 9-10 cm apart from base of plant &amp; 7-8 cm deep as ring method</td>
</tr>
<tr>
<td>Brinjal</td>
<td>165</td>
<td>6</td>
<td>Fertilizer should be applied at 6-10 cm apart from base of plant &amp; 6-8 cm deep as ring method</td>
</tr>
<tr>
<td>Tomato</td>
<td>150</td>
<td>6</td>
<td>Fertilizer should be applied at 6-10 cm apart from base of plant &amp; 6-8 cm deep as ring method</td>
</tr>
<tr>
<td>Potato</td>
<td>220-250</td>
<td>8</td>
<td>Fertilizer should be applied at ground level between tubers at time of planting.</td>
</tr>
</tbody>
</table>
Fertilizer recommendation for various mixed & intercropping systems
Future Researchable Issues

Nutrient Management in:
- Risk-prone ecosystems
- Multiple cropping systems
- No tillage/minimum tillage systems
- Hill farming

Ecosystem based information on mineralization and nutrient release pattern of organic materials need to be generated for standardization of organic fertilizers.

Fertilizer management for traditional fruits and their quality