WELCOME

Development of Fertilizer Recommendation in Bangladesh

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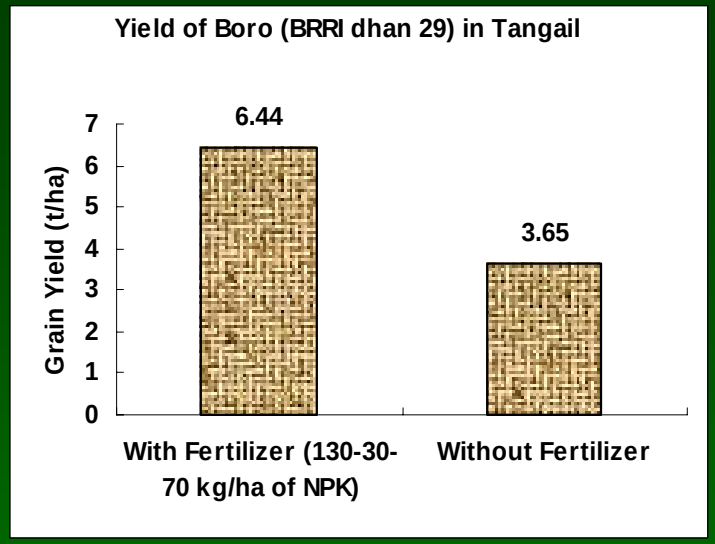
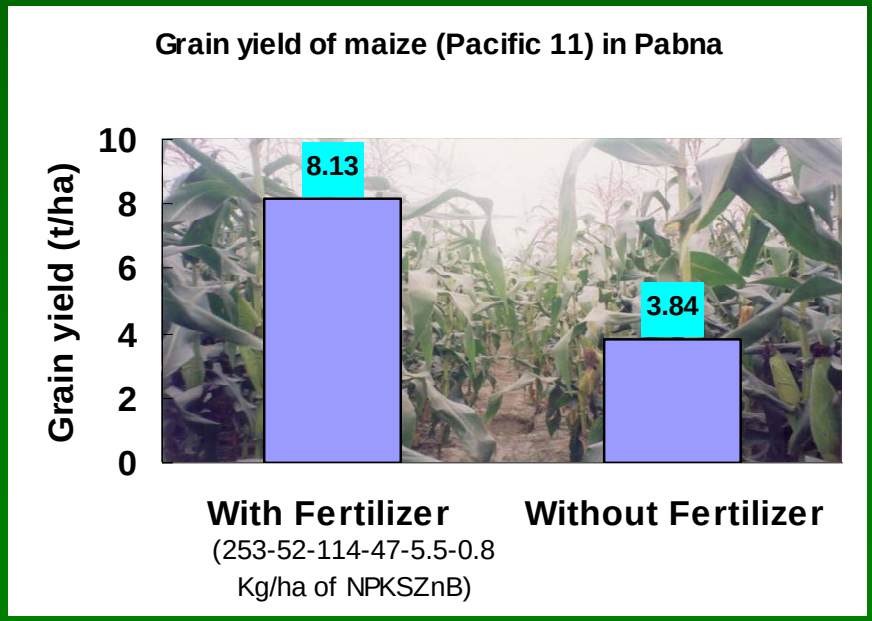
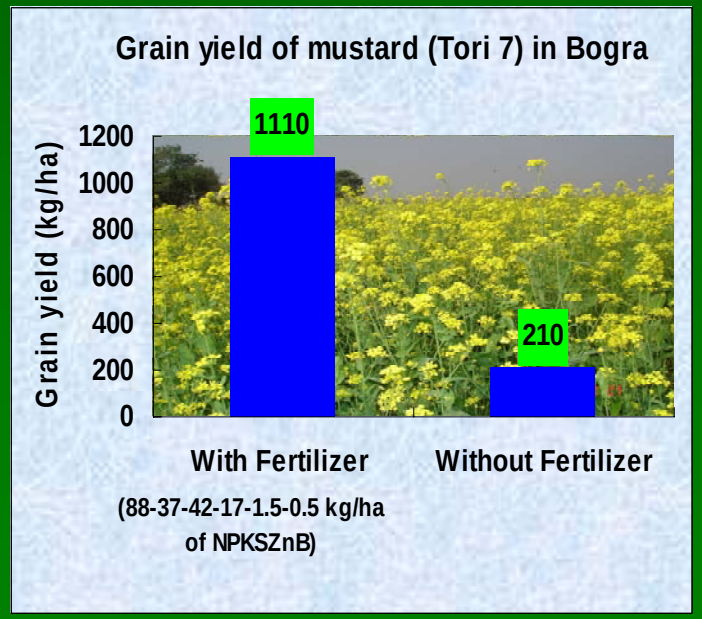
NPKSZn
BR3


Yield of Boro (BRRI dhan 29) in Tangail
Grain Yield (t/ha)
0
1
2
3
4
5
6
7
6.44
3.65
With Fertilizer (130-30-70 kg/ha of NPK)
Without Fertilizer


Grain yield of maize (Pacific 11) in Pabna
Grain yield (t/ha)
0
2
4
6
8
10
8.13
3.84
With Fertilizer
Without Fertilizer
(253-52-114-47-5.5-0.8 Kg/ha of NPKSZnB)


Grain yield of mustard (Tori 7) in Bogra
Grain yield (kg/ha)
0
200
400
600
800
1000
1200
1110
210
With Fertilizer
Without Fertilizer
(88-37-42-17-1.5-0.5 kg/ha of NPKSZnB)

Nutrient Recommendation/Management

Why?

What Source, Rate?

How to apply?

When to apply?

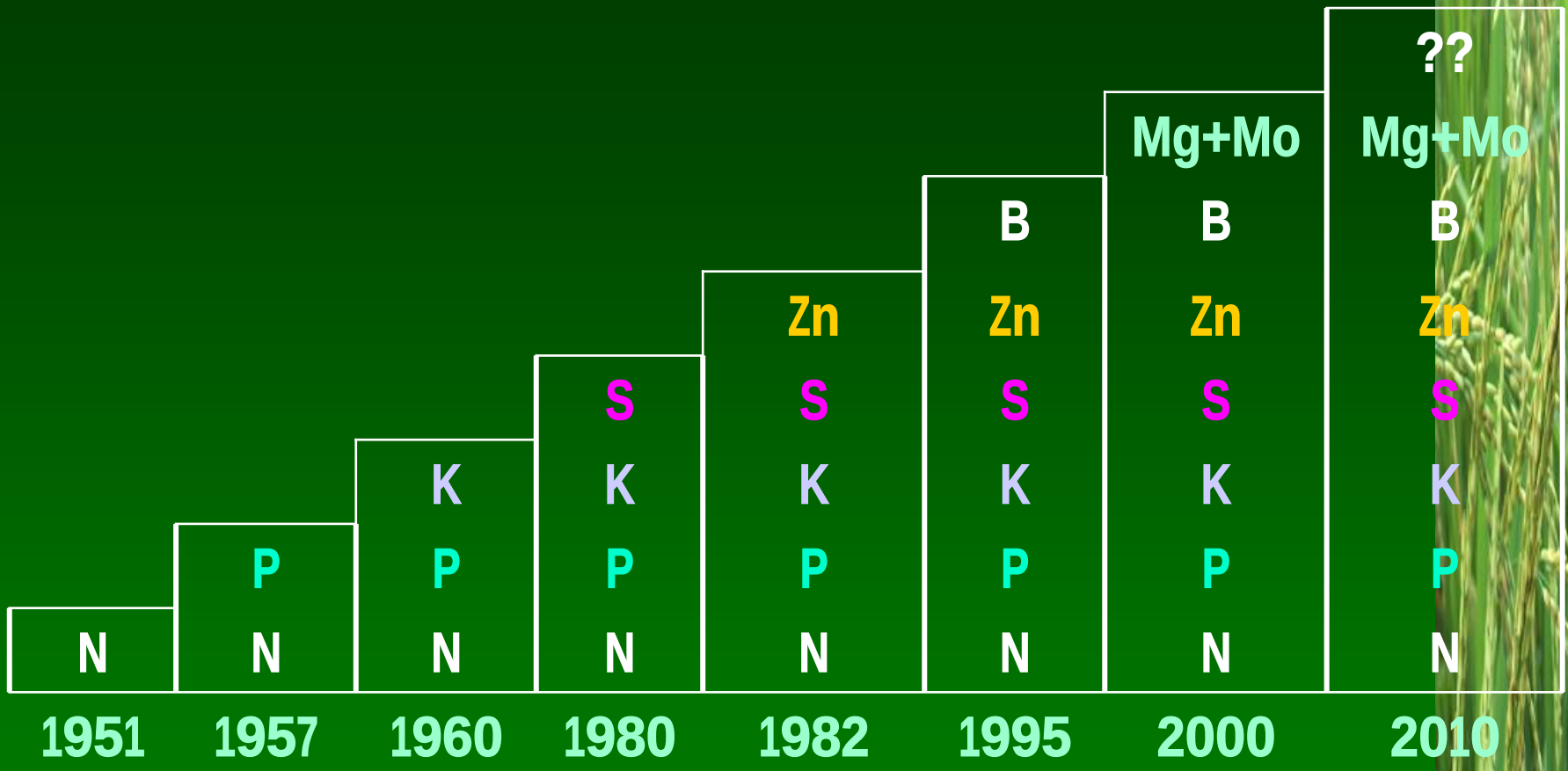
Where to apply?

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

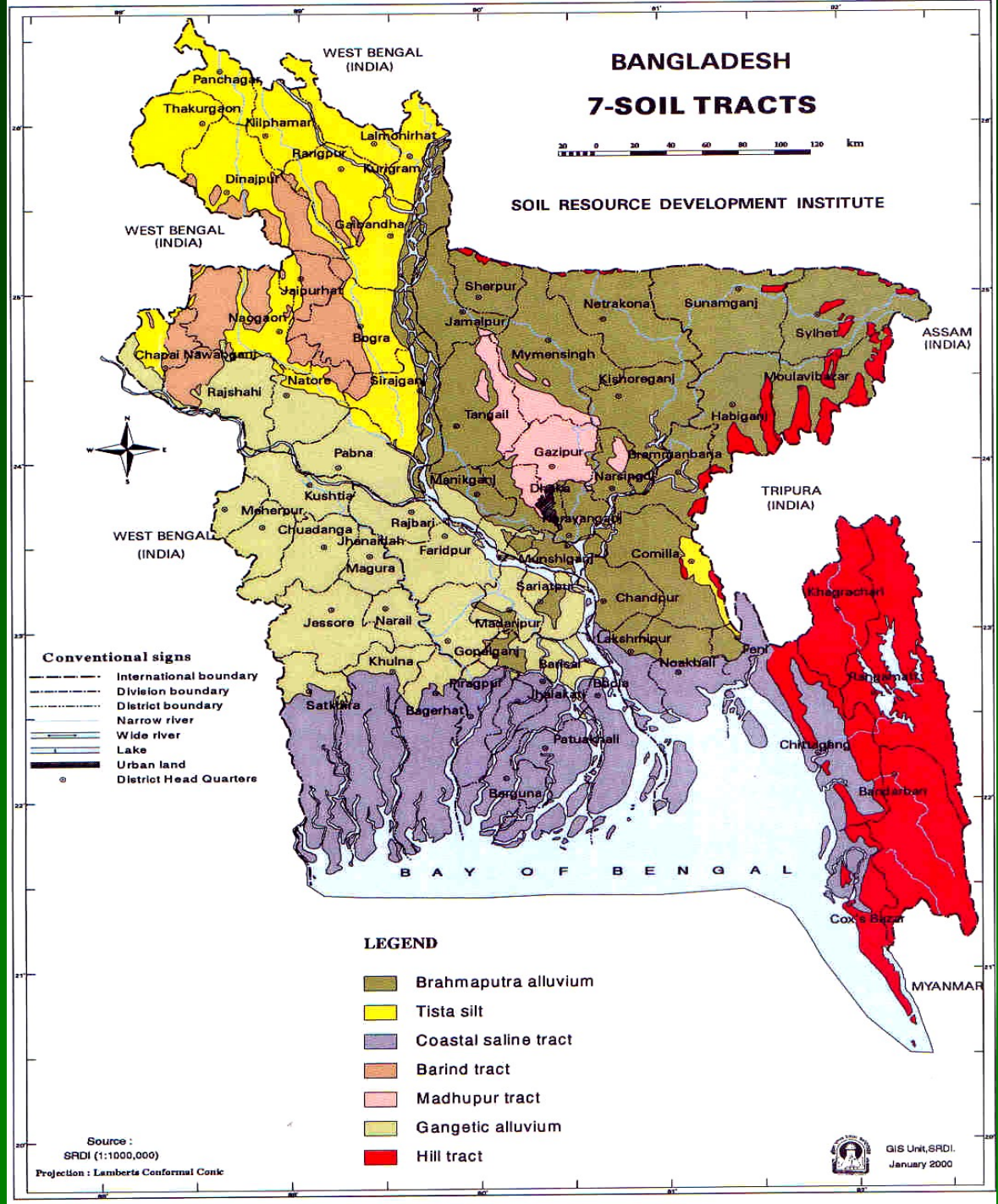
- Farmers acquainted with chemical fertilizers and encouraged to use them along with organic manures.

- 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

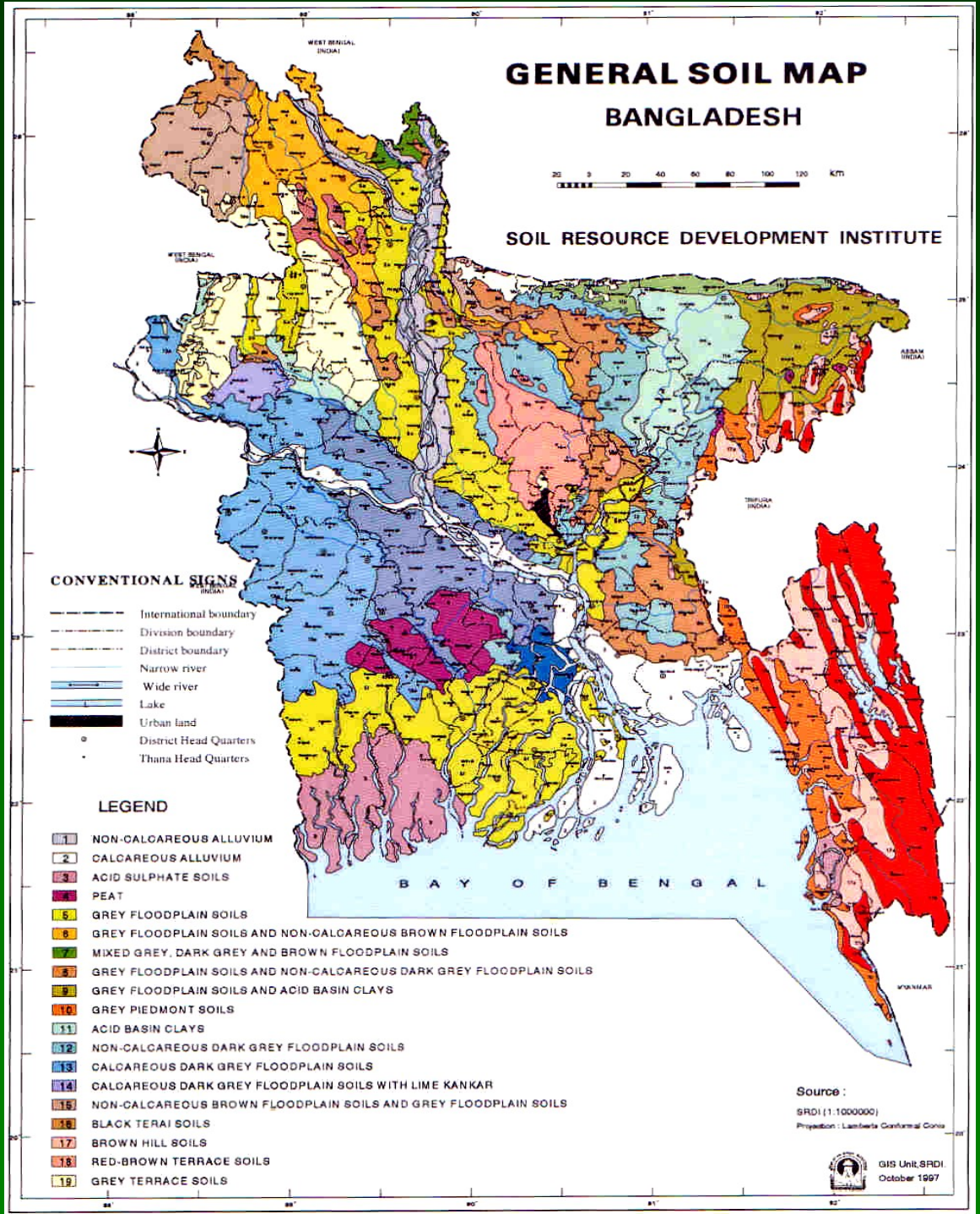


Based on soil nutrient status and fertilizer trials conducted it was found necessary that different fertilizer combinations were required for different soil tracts

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

BARC published its first Fertilizer Recommendation Guide “Fertilizer Guide for Major Crops of Bangladesh” in 1979.

•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.

A revised guide entitled “1985 Fertilizer Recommendation Guide for most Bangladesh Crops” was published in 1985.

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

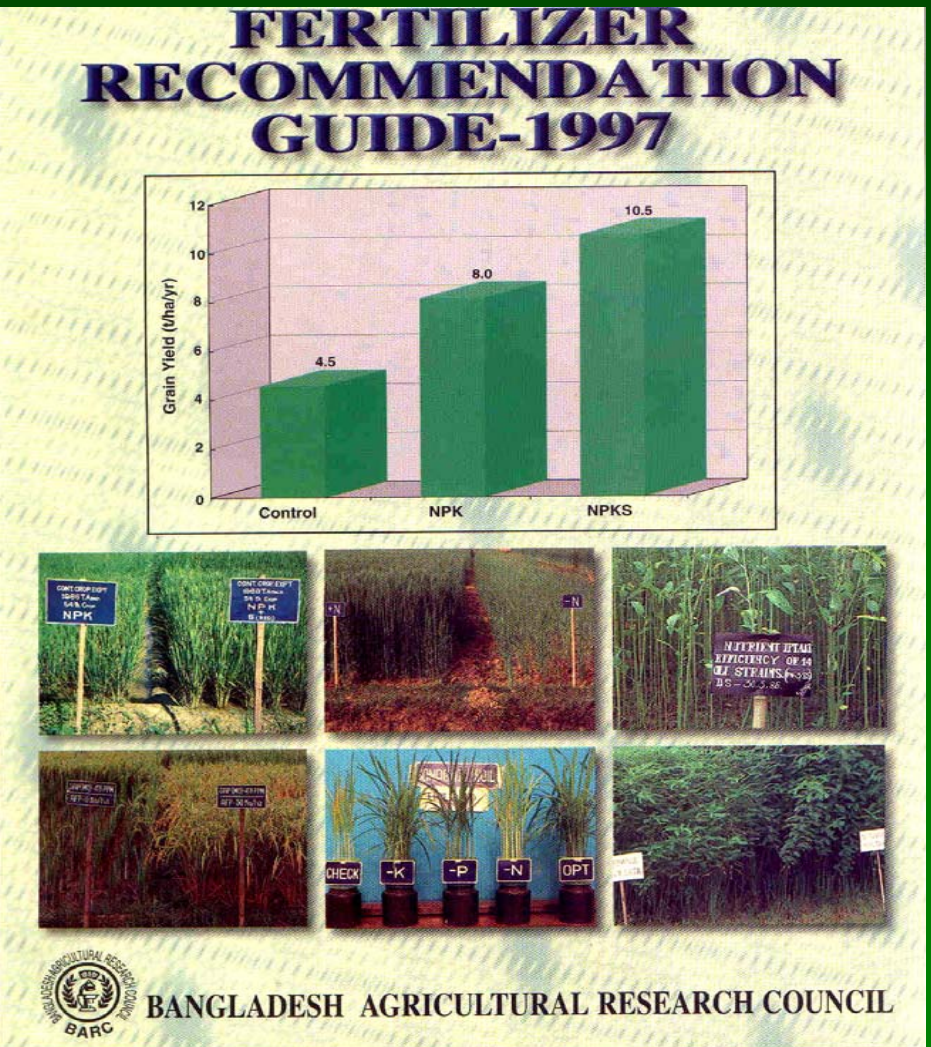
The guide contains two parts:

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

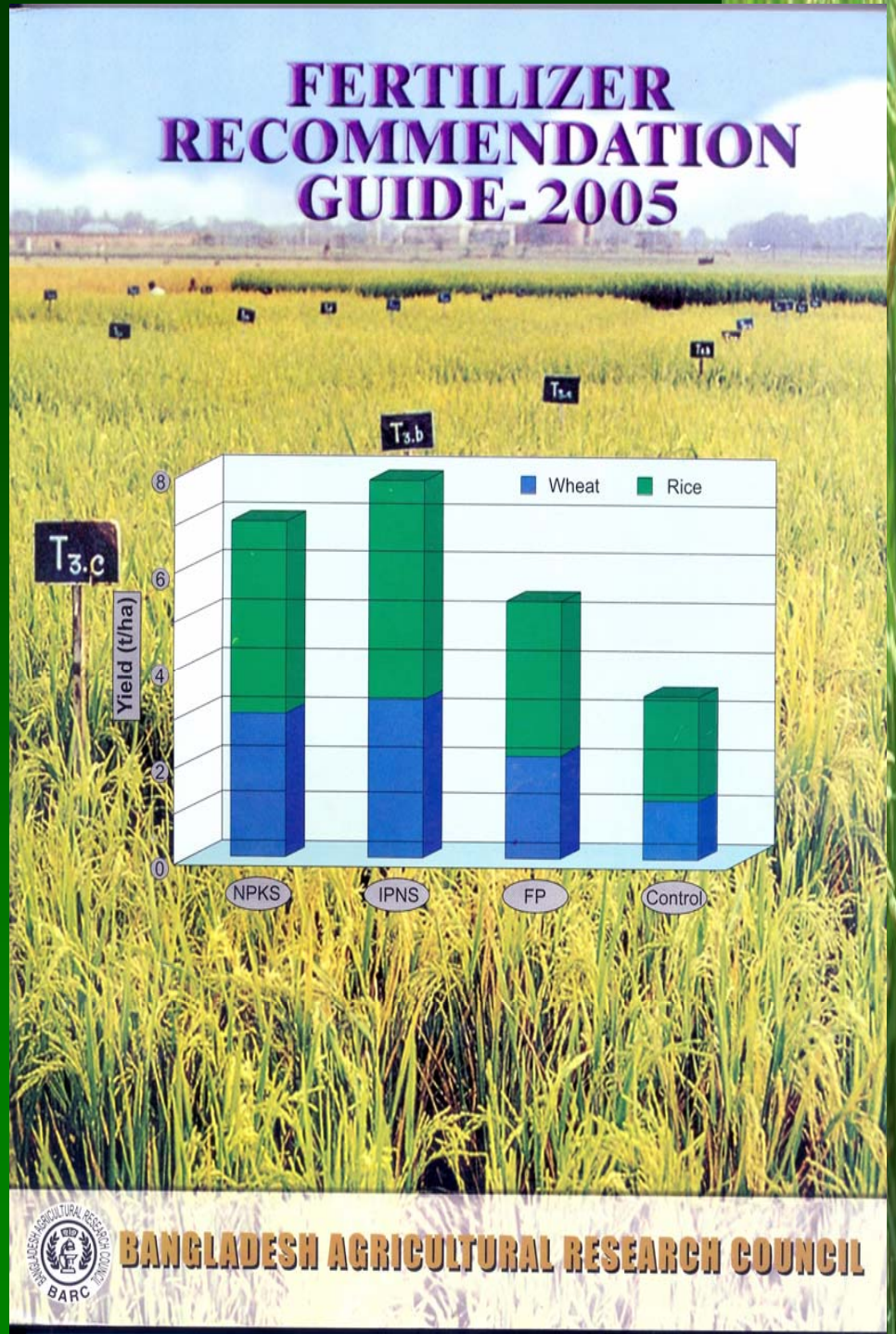


It recommends fertilizer application for four soil fertility levels for both high and moderate yield goals

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:

• Diversity of agro-ecological regions	• Soil nutrient levels
• Major cropping patterns	• Crop response to added nutrient and management
• Land type	• Calcareous/non calcareous/red soils
• Soil texture	• Rainfed/irrigated condition
• Soil pH	• Rationale of fertilizer application
• Soil organic matter status	• Resource base of farmers and yield goals

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

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.

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

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

Crop	Percent of the recommended doses	
	Moderately acidic to slightly alkaline	Strongly acid and calcareous
Rice Jute	**50-60**	**60-70**
Maize, vegetables, spices & pulses	**60-70**	**100**

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 2nd or 3rd 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

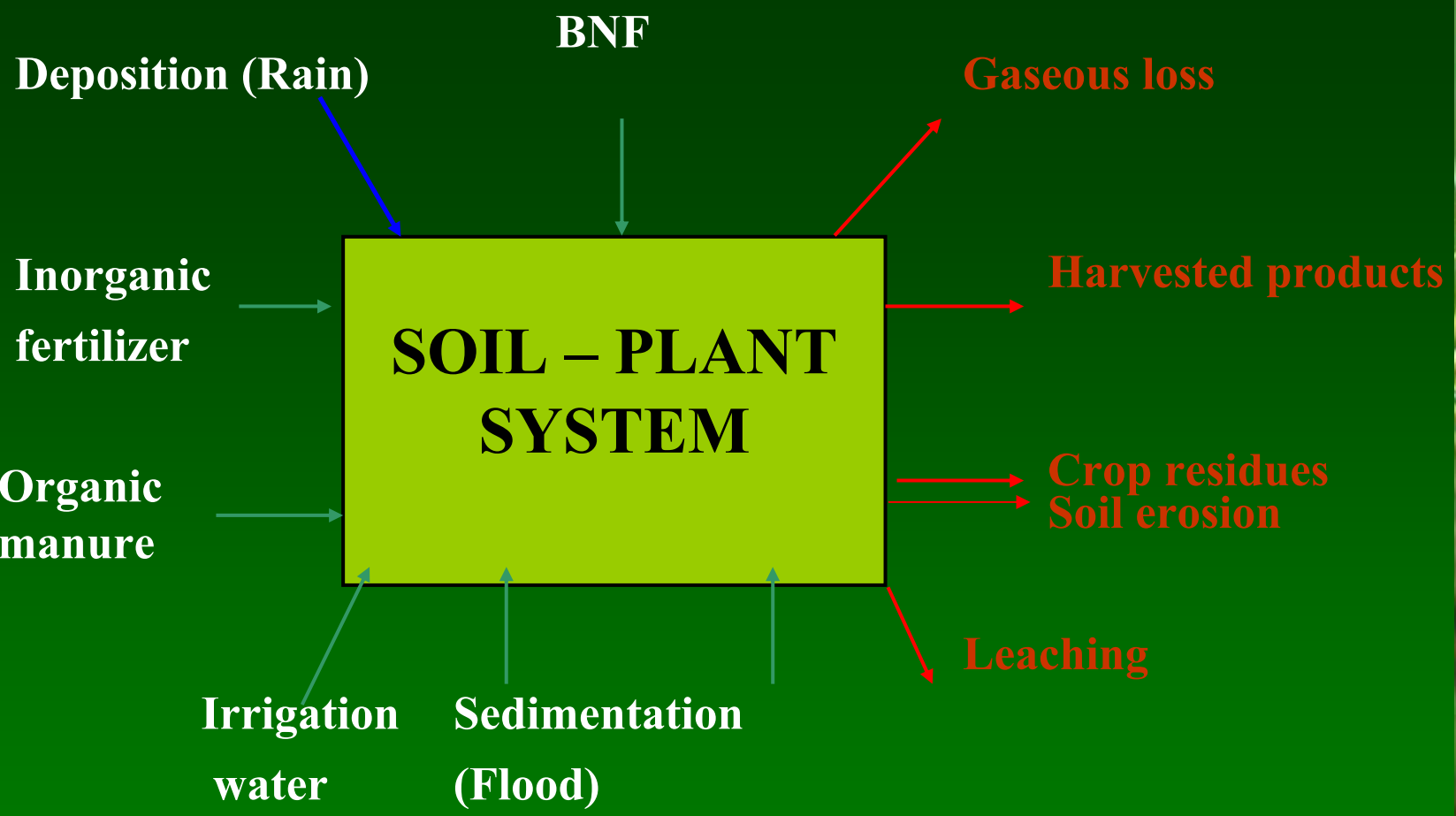
New content included in FRG 2005

- 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

New content

- 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

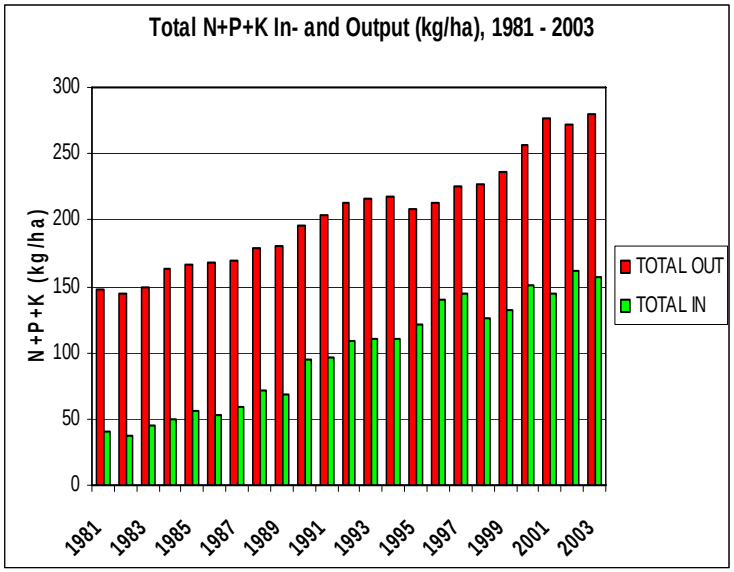
NUTRIENT BALANCE IS INPUT - OUTPUT RELATIONS IN SOIL-PLANT SYSTEMS

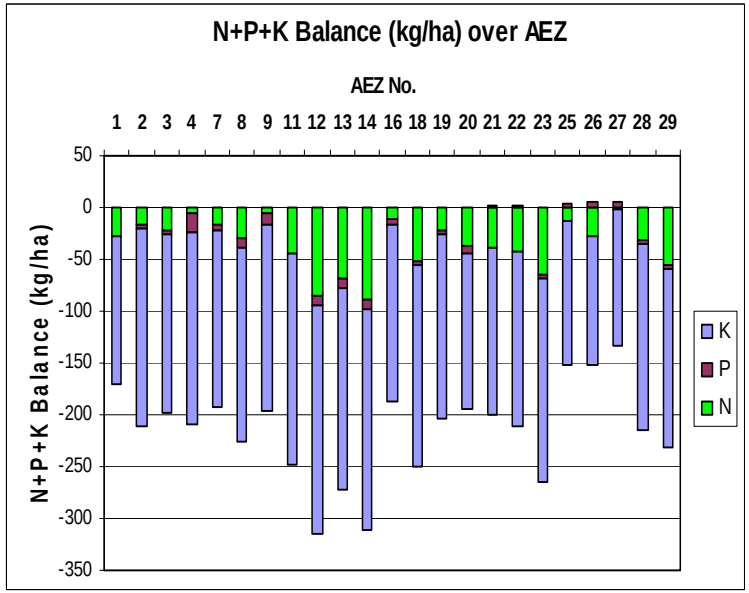


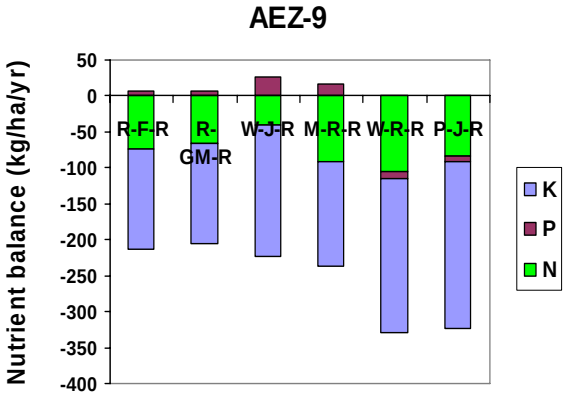
Input > Output : Nutrient build-up
(Pollution in extreme cases)

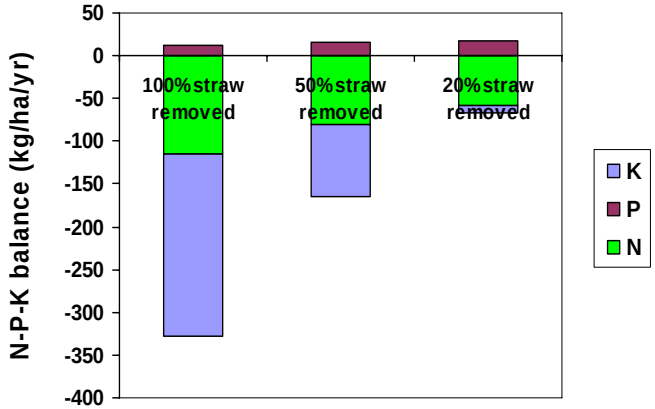
Input < Output : Nutrient depletion (mining)

Input = Output: Sustainable system


Total N+P+K In- and Output (kg/ha), 1981 - 2003
N+P+K (kg/ha)
300
250
200
150
100
50
0
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
TOTAL OUT
TOTAL IN


N+P+K Balance (kg/ha) over AEZ
AEZ No.
1 2 3 4 7 8 9 11 12 13 14 16 18 19 20 21 22 23 25 26 27 28 29
N+P+K Balance (kg/ha)
50
0
-50
-100
-150
-200
-250
-300
-350
K
P
N

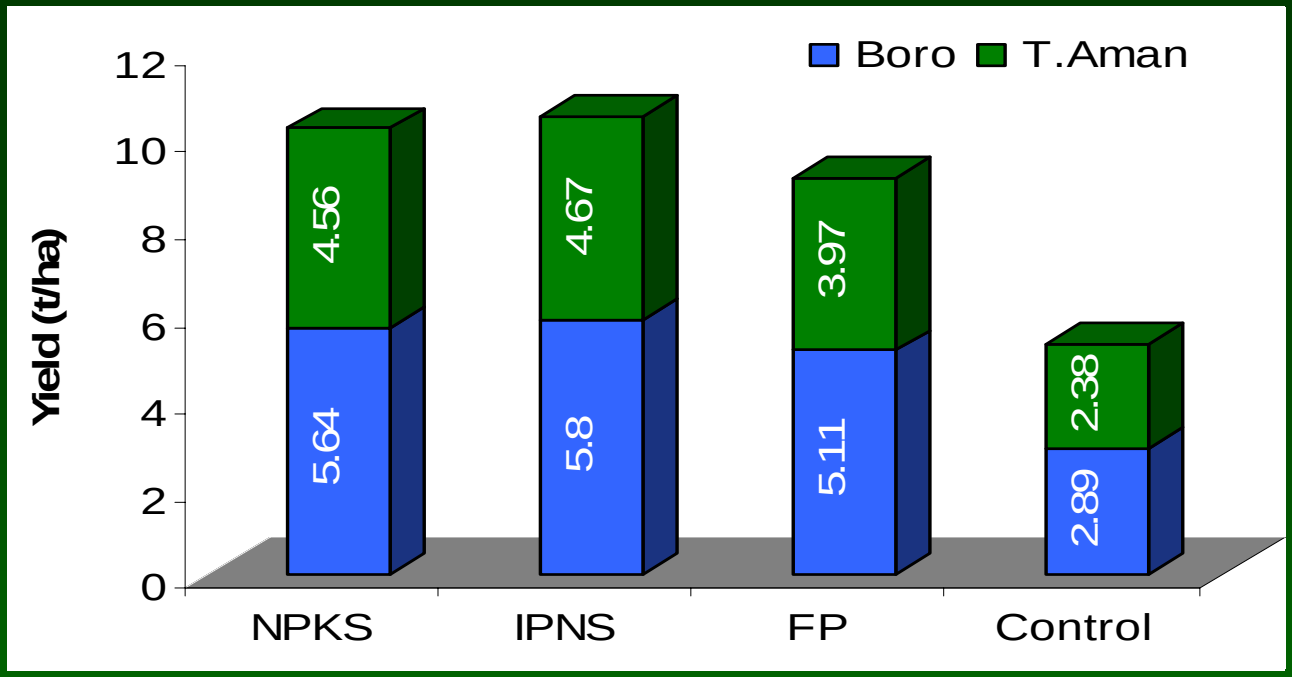

AEZ-9
Nutrient balance (kg/ha/yr)
50
0
-50
-100
-150
-200
-250
-300
-350
-400
R-F-R
R-GM-R
W-J-R
M-R-R
W-R-R
P-J-R
K
P
N

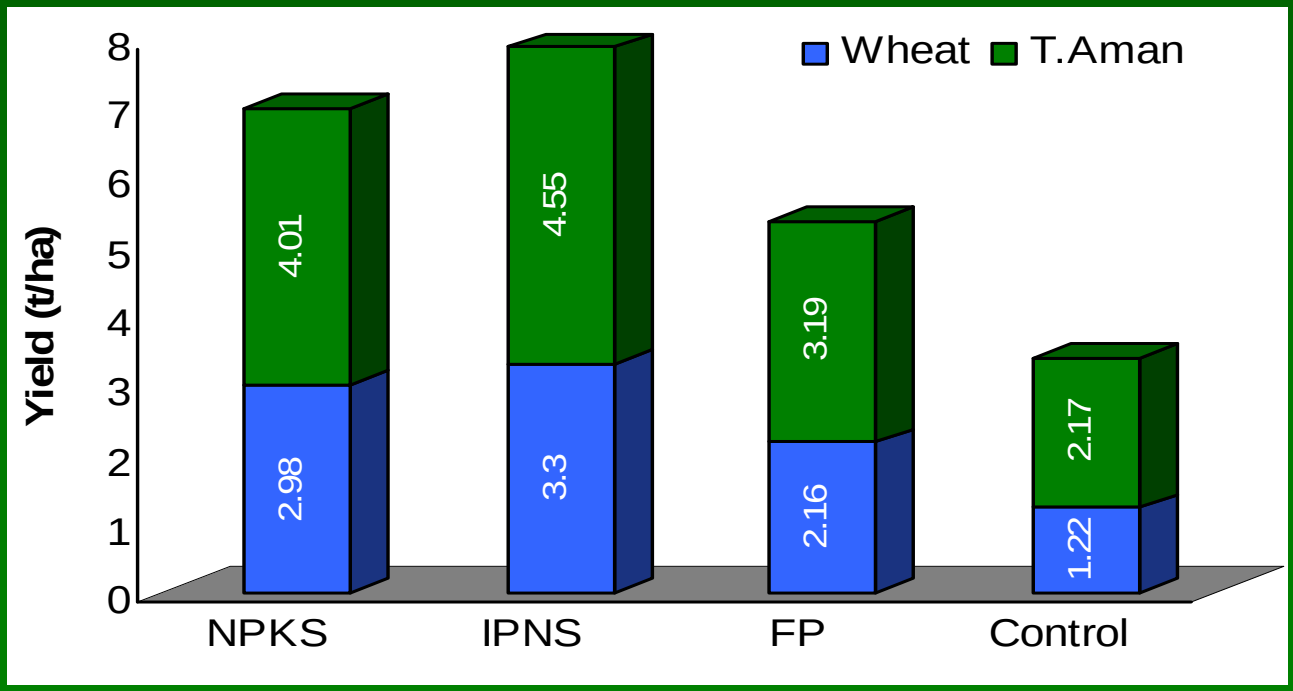

N-P-K balance (kg/ha/yr)
50
0
-50
-100
-150
-200
-250
-300
-350
-400
100% straw removed
50% straw removed
20% straw removed
K
P
N

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.


Boro
T.Aman
Yield (t/ha)
12
10
8
6
4
2
0
5.64
4.56
5.8
4.67
5.11
3.97
2.89
2.38
NPKS
IPNS
FP
Control


Wheat
T.Aman
Yield (t/ha)
8
7
6
5
4
3
2
1
0
2.98
4.01
3.3
4.55
2.16
3.19
1.22
2.17
NPKS
IPNS
FP
Control

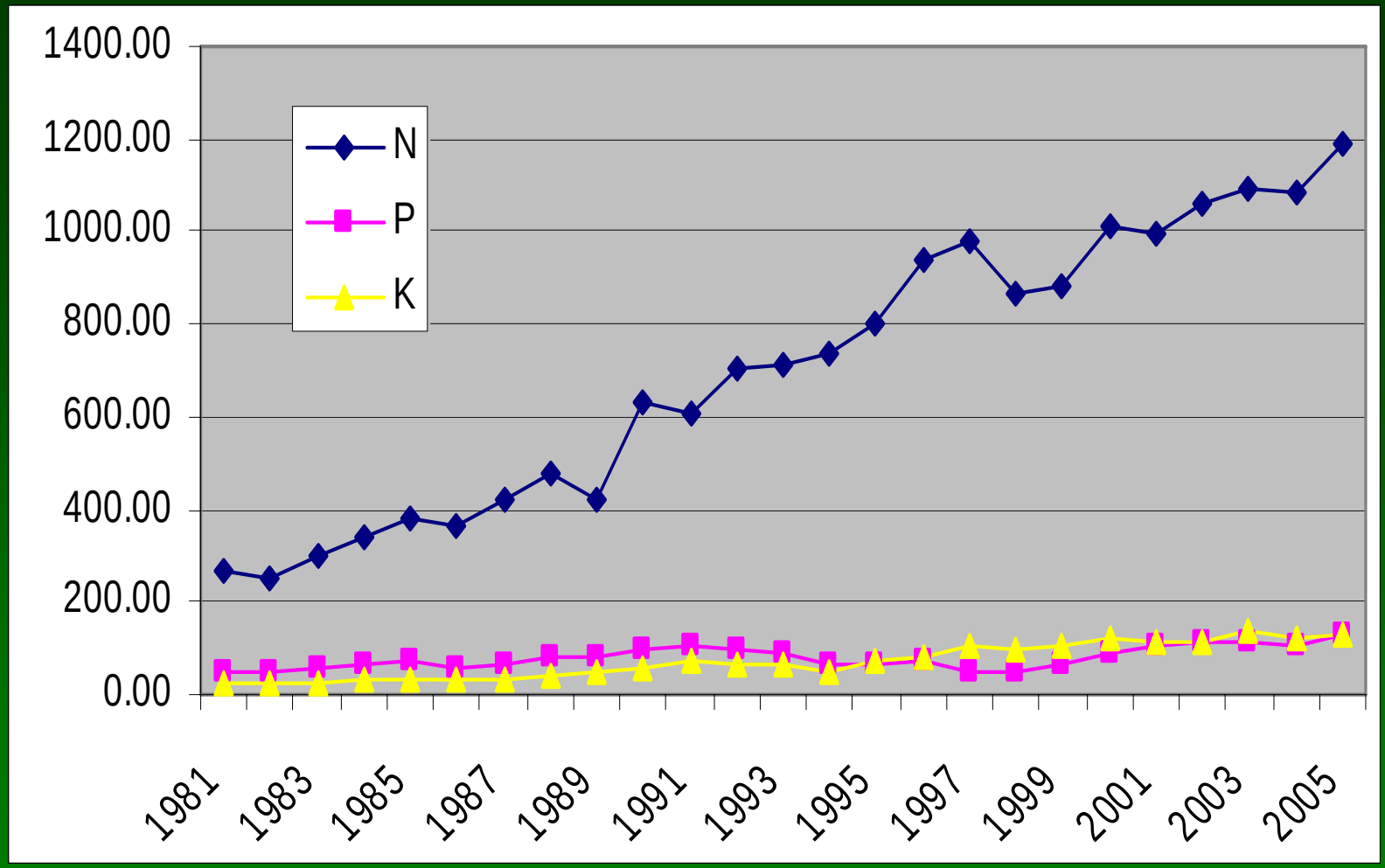


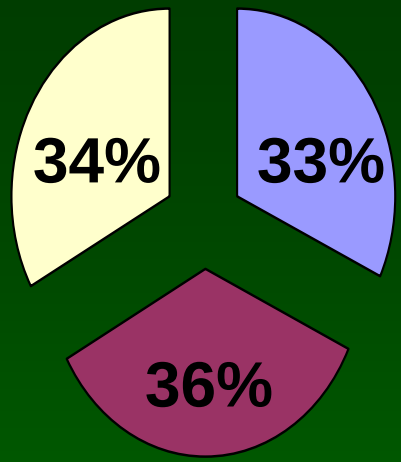
Fig. 1: Fertilizer sales by nutrients by year

Table 1. Use ratio of NPK during 1970-2000

Year	Use ratio
	N : P : K
1970	11 : 2 : 1
1975	13 : 2 : 1
1980	12 : 2 : 1
1985	12 : 2 : 1
1990	8 : 1.5 : 1
1995	12 : 1 : 1
2000	8 : 0.8 : 1
2005	9 : 1 : 1
Desirable uptake ratio	5 : 1 : 4

Nitrogen Use Efficiency is low

Losses



Negative economic impact

Negative environmental impact

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

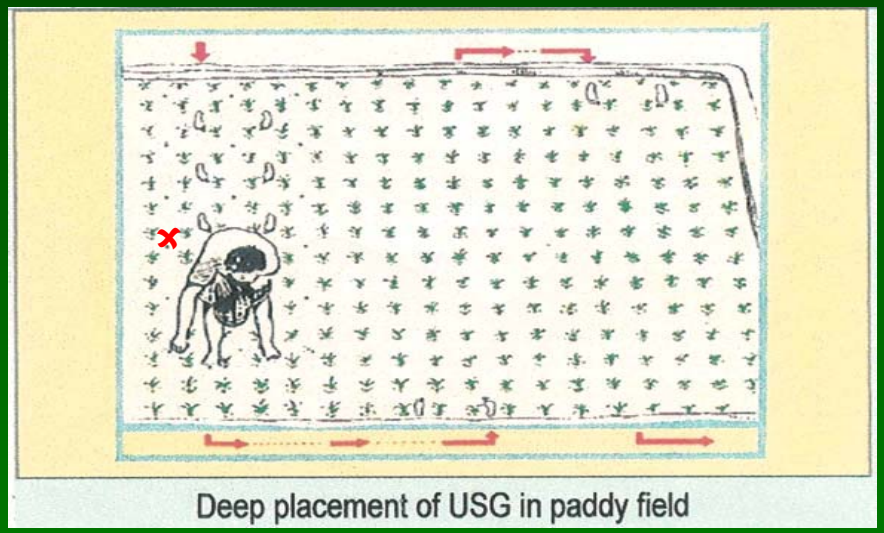
USG (0.9 gram)

UMG (1.8 gram)

UMG (2.7 gram)

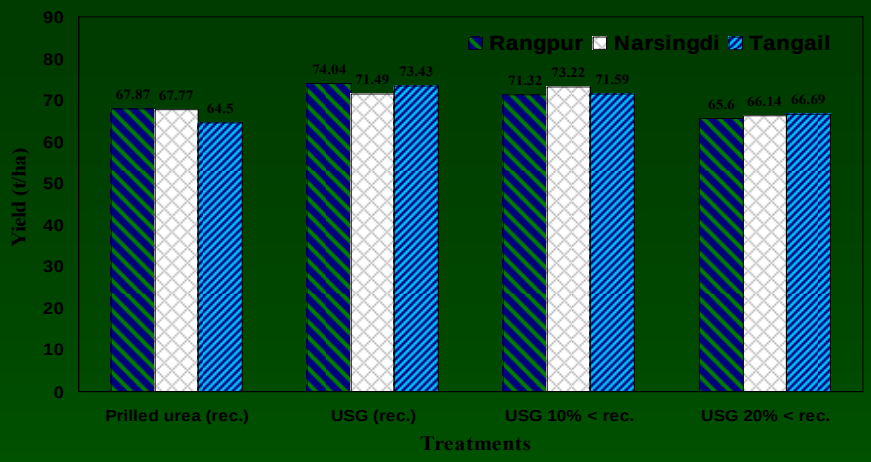
Its application in the field…

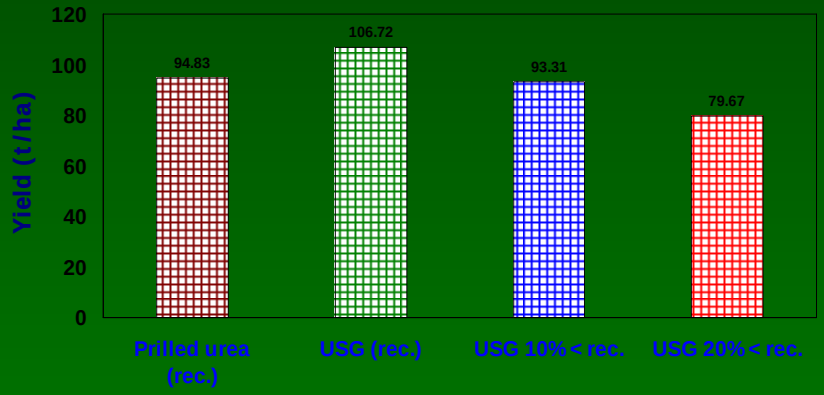
- Amount adjusted to the recom. N dose
- 8-10 cm depth
- Within one week of transplanting

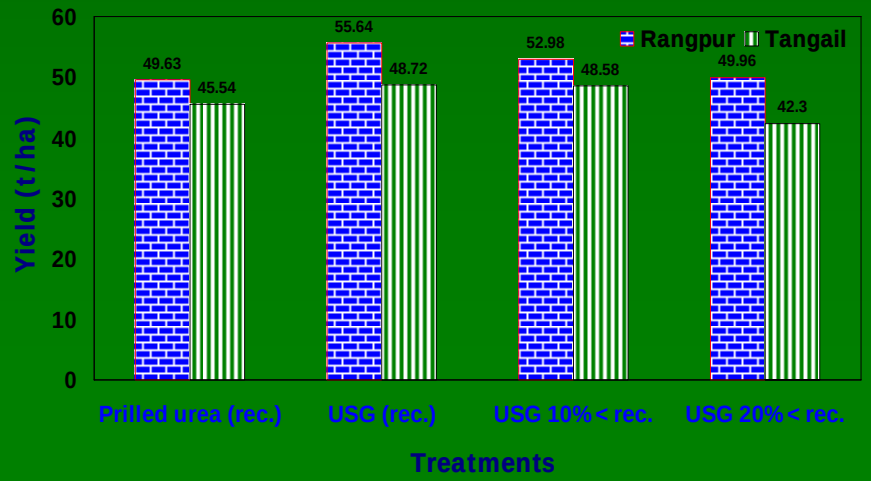


Deep placement of USG in paddy field

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


Rangpur
Narsingdi
Tangail
Yield (t/ha)
67.87
67.77
64.5
74.04
71.49
73.43
71.32
73.22
71.59
65.6
66.14
66.69
Prilled urea (rec.)
USG (rec.)
USG 10% < rec.
USG 20% < rec.
Treatments


Yield (t/ha)
94.83
106.72
93.31
79.67
Prilled urea (rec.)
USG (rec.)
USG 10% < rec.
USG 20% < rec.
Treatments


Rangpur
Tangail
Yield (t/ha)
49.63
45.54
55.64
48.72
52.98
48.58
49.96
42.3
Prilled urea (rec.)
USG (rec.)
USG 10% < rec.
USG 20% < rec.
Treatments

Recommendation

Crop	Dose of USG (kg ha^{-1})	No. of ball/ plant (g)	Application method
Cabbage	370	10	Fertilizer should be applied 9-10 cm apart from base of plant & 7-8 cm deep as ring method
Cauliflower	220	8	Fertilizer should be applied 9-10 cm apart from base of plant & 7-8 cm deep as ring method
Brinjal	165	6	Fertilizer should be applied at 6-10 cm apart from base of plant & 6-8 cm deep as ring method
Tomato	150	6	Fertilizer should be applied at 6-10 cm apart from base of plant & 6-8 cm deep as ring method
Potato	220-250	8	Fertilizer should be applied at ground level between tubers at time of planting.

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


Thank you