

Competitive Research Grant (CRG)
Sub-Project Completion Report

On

**Updating of Fertilizer Recommendation through
Interpretation of Research Results Generated by
the NARS Institutes**

Project Duration

July 2017 to September 2018

Implementing Organization



Soils Unit

Natural Resources Management Division
Bangladesh Agricultural Research Council (BARC)
Farmgate, Dhaka-1215

Submitted to

PIU-BARC (NATP Phase-II)
BARC Complex, Farmgate, Dhaka-1215

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Printed at:

Acronyms

NRM	: Natural Resources Management
BARC	: Bangladesh Agricultural Research Council
FRG	: Fertilizer Recommendation Guide
NARS	: National Agricultural Research System
M-D	: Member-Director
CSO	: Chief Scientific Officer
BARI	: Bangladesh Agricultural Research Institute
BRRRI	: Bangladesh Rice Research Institute
BJRI	: Bangladesh Jute Research Institute
BSRI	: Bangladesh Sugar Crop Research Institute
BINA	: Bangladesh Institute of Nuclear Agriculture
BTRI	: Bangladesh Tea Research Institute
BFRI	: Bangladesh Forest Research Institute
SRDI	: Soil Resource Development Institute
DAE	: Department Agriculture Extension
AEZ	: Agro-ecological Zone
LoA	: Letter of Agreement
OFRD	: On-Farm Research Division
LIV	: Local Improved Variety
IFDC	: International Fertilizer Development Center
KGF	: Kishi Gobeshana Foundation

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Executive Summary

A major mandate of Soils Unit of Natural Resources Management (NRM) Division, Bangladesh Agricultural Research Council (BARC) is to publish and periodic updating of Fertilizer Recommendation Guide (FRG). Updating is done usually at five years interval. Six FRGs have so far been published in 1979, 1985, 1989, 1997, 2005 and 2012. The present FRG-2018 is the seventh edition. Updating is done with up to date Fertilizer Recommendations for different crops, cropping patterns and multiple cropping developed by different National Agricultural Research System (NARS) institutes. The Guides are being widely used by all level of stakeholders like extension personnel, scientists, GO and NGO personnel, agriculturists, policy makers etc. All the previous FRGs were published in English, for which farmers cannot use the book. They need help of extension personnel or scientists for using the book. Realizing the fact the FRG-2018 has also been published in Bengali this year as “mvi mycvwikgvjv nvZeB-2018Ó in farmer friendly language in addition to English version. The Bengali version “mvi mycvwikgvjv nvZeB-2018Ó is not the as such translation of the English version. Bengali version contains only some important chapters in the text part in different forms usable for the farmers. For wide circulation of Bengali version, web application and mobile apps have been developed and uploaded in BARC website (as AbjvBb mvi mycvwikgvjv) and Google Play Store (as frg.barcapps).

A 12-membered “Editorial Board” was formed with Member-Director (NRM), BARC as the Convener; Chief Scientific Officer (Soils), BARC as the Member-Secretary and soil scientists from different NARS institutes and universities as the members for preparation of FRG-2018.

Up to date information on fertilizer recommendation for the existing major crops and cropping patterns of the country were collected from different NARS institutes like BARI, BRRI, BJRI, BSRI, BINA, BTRI and BFRI. Information on the existing cropping patterns at the farm level were collected from DAE, BARI and BRRI. Some other relevant information like adulteration of fertilizers and maps on different aspects of soil fertility were collected from SRDI. The information were validated, compiled and edited in the Editorial Board and the draft manuscript of the updated FRG-2018 was prepared. Both English and Bengali versions of FRG-2018 composed of ‘text part’ and ‘fertilizer recommendation part’. The Text part includes basic information, principles and theories of soil fertility and fertilizer management; and the fertilizer recommendation part includes soil test based fertilizer recommendation for single crops and AEZ based fertilizer recommendation for major cropping patterns and multiple cropping.

The FRG-2018 includes some new chapters in the text part like soil acidity and liming, fertilizer management for conservation agriculture, roof top gardening and floating agriculture, fertilizer management for degraded land farming like hill farming, coastal farming, haor farming and charland farming. In the fertilizer recommendation part, a total of 475 fertilizer recommendations have been made, of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping. Fertilizer recommendations for five crops (Dragon Fruit, Star Goose Berry, Fig, Indian Olive and Sugar Beet) have been newly added in FRG-2018. On the other hand LIVs and low yield varieties of different crops and tobacco have been discarded.

Two separate workshops were organized n draft English and Bengali versions of FRGs-2018 each with 80 participants from different NARS institutes, DAE, BADC, senior scientists, university teachers and farmers. Suggestions and comments from the workshops were incorporated to finalize the FRG-2018. A software company was hired to prepare the web application and mobile apps of the Bengali version of FRG (mvi mycvwikgvjv nvZeB-2018).

A total of 3000 copies of English version and 11,000 copies of Bengali version of FRG-2018 were published and distributed among different stakeholders. Pdf copies of both English and Bengali versions of FRG-2018 have also been uploaded in BARC website. The web application (frg.barcapps.gov.bd) has been uploaded in BARC website (as অন লাইন সার সুপারিশমালা) and the mobile apps has been uploaded in Google Play Store (as f r g.bar capps).

CRG Sub-Project Completion Report (PCR)

A. Sub-project Description

1. **Title of the CRG Sub-Project:** Updating of Fertilizer Recommendation through Interpretation of Research Results Generated by the NARS Institutes

2. **Implementing organization:** Bangladesh Agricultural Research Council

3. **Name and full address with phone, cell and E. mail of PI/Co-PIs:**

Principal Investigator(s)- From 17 July 2017 to 03 September 2018

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Co-Principal Investigator(s)-(Proponent Institute/Collaborating

Dr. Md. BaktearHossain

Principal Scientific Officer (Soils)

Bangladesh Agricultural Research Council

Farmgate, Dhaka-1215, Phone: 02-9112764

Cell: 01711 201 441

E. mail: baktear@gmail.com

4. **Sub-project budget (Tk.)**

4.1 Total (Tk.) : Tk. 49,38000/- (Forty nine lac and thirty eight thousand)

4.2 Revised (if any) :

5. **Duration of Sub-project:**

5.1 Start date (based on LoA signed): 17 July 2017

5.2 End date; 30 September 2018

6. **Justification of undertaking the sub-project:**

Soil is the most important natural resource of Bangladesh. Pressure on this resource is spontaneously increasing due to increased demand of food for increasing population. The country has a wide diversity and complexity of soils at short distances due to a complex nature of physiography, parent material, hydrology, drainage conditions etc. This has

become further complicated by human interferences. Continuous changes are taking place in the soil fertility status due to intensive cropping, organic matter depletion, soil erosion, nutrient deficiency/toxicity, drainage impedence/water logging followed by degradation of soil physical and chemical properties and soil salinity/alkalinity etc. Cropping intensity of the country is increasing steadily, which by now is about 200 percent. Use of modern crop varieties are also increasing, which is enhancing higher nutrient uptake and nutrient mining. All these factors, in turn are resulting in gradual decrease of soil fertility. As a result nutrient supplying capacity of the soils is gradually going down. Farmers of the country often fail to realize detrimental effects of these factors while making their own decisions on fertilizer use. Different types of fertilizers are used in the country as the source of different plant nutrients. Except urea almost all the fertilizers leave some residual effects in the soil, which can be used by the subsequent crops. Nutrient uptake also varies widely among different crops/varieties and cropping patterns. Effect of climate change is also emerging as an important issue in soil fertility and fertilizer management in the country. The extent and intensity of both soil and water salinity in the coastal areas of the country is gradually increasing, which should be given due attention to address the issue. The expected elevated temperature, erratic rainfall, frequent natural hazards like flood, drought, cyclone, tidal surge etc., which the country is presently experiencing, also has effect on soil fertility and fertilizer management in the country.

Fertilizer recommendation is a dynamic process in view of the generation of new knowledge, changes in soil nutrient status, changes in crops/varieties and cropping patterns and associated management practices. Research on soil fertility and fertilizer management is being carried out in all the crop based NARS (National Agricultural Research System) institutes of the country on a regular basis. Fertilizer recommendations for different crops and cropping patterns are being updated regularly under changing situation. Changes in soil fertility status of the country over time are also being monitored on regular basis. Accumulation of all these information and periodic updating at a certain interval is essential to harness benefits from these information for achieving higher food production and food security of the country.

The Soils Unit of Natural Resources Management Division of BARC is mandated to publish and periodic updating of FRG with updated fertilizer recommendations developed at different NARS institutes. Updating is done usually at five years interval. Six Fertilizer Recommendation Guides have been published so far in 1979, 1985, 1989, 1997, 2005 and 2012. The guide is being widely used by farmers, block supervisors, extension personnel, scientists and policy makers as a guide for production planning at local and national level.

During updating of Fertilizer Recommendation Guide, the following major areas were taken into consideration.

- Updating nutrient status of different AEZs
- Changes in crops/cropping patterns
- Balanced fertilization (to check large K mining)
- Promotion of bio-fertilizer
- Increasing soil organic matter (SOM)

- Fertilizer management in problem soils (saline soils, acid sulfate soils, hill soils, carlands etc.)
- Socio-economic factors in Fertilizer Management
- Use of micronutrients
- Quality control of fertilizers
- Yield target

7. Sub-project goal: Publication of updated Fertilizer Recommendation Guide (FRG) for sustainable crop production through balanced fertilization

8. Sub-project objectives:

- Updating of fertilizer recommendation for crops and cropping patterns under different Agro-ecological Zones (AEZs).
- Publishing the updated FRG.

9. Implementation location:

Research information and cropping pattern information from the whole country will be collected from different NARS institutes and DAE, which will be compiled at BARC, Dhaka

10. Methodology in brief:

Updating of FRG is done usually at five years interval. Six FRGs have so far been published in 1979, 1985, 1989, 1997, 2005 and 2012. The FRG-2018 is the seventh edition. All the previous FRGs were published in English. This year FRG has also been published in Bengali as “mvi mycvwikgvjv nvZeB-2018Ó in farmer friendly language in addition to English version. The Bengali version “mvi mycvwikgvjv nvZeB-2018Ó is not the as such translation of the English version. Only the salient items of FRG-2018 in modified forms usable for the farmers have been incorporated in the Bengali version. For wide circulation, the Bengali version has been made available on-line and off-line as mobile apps.

Activities of updating of FRG-2018 were initiated immediately after signing of Letter of Agreement (LoA) on 17 July 2017. A 12-Membered Editorial Board was formed with the scientists from different NARS institutes and BAU, and extension personnel from DAE for preparation of FRG-2018. The composition of the Editorial Board was as follows:

- | | |
|---|------------|
| 1. Dr. Sultan Ahmed, Member Director (NRM), BARC | : Convener |
| 2. Dr. M. Jahiruddin, Professor, Department of Soil Science, BAU | : Member |
| 3. Mrs. Sultana Razia, Former Member Director (NRM) BARC | : Member |
| 4. Dr. Rowshan Ara Begum, Former CSO, Soil Science Division, BARI | : Member |
| 5. Dr. Jatish Chandra Biswas, Former CSO, Soil Science Division, BARI | : Member |
| 6. Dr. A.S.M. Mahbubur Rahman, CSO and Head, OFRD, BARI | : Member |
| 7. Dr. Md. Mohsin Ali, CSO and Head, Soil Science Division, BINA | : Member |
| 8. Mr. Md. Saiful Islam, Additional Director (Implementation), DAE | : Member |
| 9. Dr. Md. Moqbul Hossain, Former PSO, Central Laboratory, SRDI | : Member |
| 10. Dr. Md. Nasimul Gani, PSO, Soil Science Department, BJRI | : Member |

11. Dr. Md. Akram Hossain, Head, Soils and Nutrition Division, BSRI : Member
12. Dr. Md. Abdus Satter, Former CSO (Soils), BARC : Member Secretary

Up to date information on fertilizer recommendation for the existing major crops and cropping patterns of the country were collected from different NARS institutes like BARI, BRRI, BJRI, BSRI, BINA, BTRI and BFRI. Information on the existing cropping patterns at the farm level were collected from DAE, BARI and BRRI. Some other related information like adulteration of fertilizers and maps on different aspects of soil fertility were collected from SRDI. The information were validated, compiled and edited in the Editorial Board and the draft manuscript of the updated FRG-2018 was prepared. Both English and Bengali versions of FRG-2018 composed of 'Text Part' and 'Fertilizer Recommendation Part'. The Text Part includes basic information, principles and theories of soil fertility and fertilizer management; and the Fertilizer Recommendation Part includes soil test based fertilizer recommendation for single crops and AEZ based fertilizer recommendation for major cropping patterns and multiple cropping.

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A total of 3000 copies of English version and 11,000 copies of Bengali version of FRG-2018 were published and distributed among different stakeholders. Pdf copies of both English and Bengali versions of FRG-2018 have also been uploaded in BARC website.



Photograph of the workshop on English version of FRG-2018



Photograph of the workshop on Bengali version of FRG-2018

11. Results and discussion:

As also mentioned before that the FRGs-2018 have been published in English as “Fertilizer Recommendation Guide-2018” and in Bengali as “mvi mycvwikgvjv nvZeB-2018Ó. The Bengali version “mvi mycvwikgvjv nvZeB-2018Óis not as such translation of the English version. There are major differences in the contents of English and Bengali versions of FRGs. Both of English and Bengali versions of FRG have two major parts, ‘the text part’ and the ‘fertilizer recommendation part’. The contents of the English of FRG-2018 are as follows:

Contents of English version of “Fertilizer Recommendation Guide-2018”

FOREWORD

PREFACE

EXECUTIVE SUMMARY

1. INTRODUCTION
 - 1.1 Updating of Fertilizer Recommendation Guide
 - 1.2 Steps in using the Fertilizer Recommendation Guide
2. PLANT NUTRIENTS
 - 2.1 Essential nutrients
 - 2.2 Functions of nutrients in plants
 - 2.3 Soil conditions causing nutrient deficiency of crops
 - 2.4 Nutrient absorption and translocation
 - 2.5 Nutrient uptake by crops
 - 2.6 Nutrient balance
3. MINERALOGY AND SOIL FERTILITY STATUS OF DIFFERENT AEZs OF BANGLADESH
 - 3.1 General features
 - 3.2 Distribution of clay minerals
 - 3.3 Soil fertility status
4. SOIL FERTILITY EVALUATION
 - 4.1 Soil analysis
 - 4.2 Critical limit of nutrients

- 4.3 Crop response to added fertilizers
- 4.4 Plant analysis
- 4.5 Diagnosis of nutrient deficiency symptoms in plants
- 5. FERTILIZERS AND THEIR USE
 - 5.1 Types of fertilizer
 - 5.2 Fertilizer use in Bangladesh
 - 5.3 Balanced use of fertilizers
 - 5.4 Nutrient use efficiency
 - 5.5 Deep placement of urea
 - 5.6 Use of bio-fertilizers
 - 5.7 Rationale of fertilizer use
 - 5.8 Time and methods of fertilizer application
- 6. SOIL ORGANIC MATTER MANAGEMENT
 - 6.1 Status of soil organic matter in Bangladesh
 - 6.2 Management of soil organic matter
 - 6.3 Integrated nutrient management
 - 6.4 Carbon sequestration
- 7. SOIL ACIDITY AND LIMING
 - 7.1 Soil acidity
 - 7.2 Liming
- 8. FERTILIZER MANAGEMENT FOR DIFFERENT FARMING SYSTEMS
 - 8.1 Fertilizer management for multiple cropping systems
 - 8.2 Fertilizer management for conservation agriculture
 - 8.3 Fertilizer management for homestead gardening
 - 8.4 Fertilizer management for roof top gardening
 - 8.5 Fertilizer management for floating bed
 - 8.6 Organic farming
 - 8.7 Fertilizer management for multiple cropping
 - 8.8 Fertilizer management in conservation agriculture
- 9. FERTILIZER MANAGEMENT IN DEGRADED LAND FARMING
 - 9.1 Fertilizer management in hill farming
 - 9.1 Fertilizer management in coastal farming
 - 9.1 Fertilizer management in haor farming
 - 9.1 Fertilizer management in char land farming
- 10. QUALITY CONTROL OF FERTILIZERS
 - 10.1 Fertilizer (Management) Act, 2006 and Fertilizer (Management) Regulation, 2007
 - 10.2 Registration of Fertilizers
 - 10.3 Fertilizer Monitoring
 - 10.4 Identification of Adulterated Fertilizers
- 11. FERTILIZER RECOMMENDATION FOR CROPS
 - 11.1 Fertilizer recommendation for different crops
 - 11.1.1 Cereal crops
 - 11.1.2 Fibre crops
 - 11.1.3 Pulse crops
 - 11.1.4 Oilseed crops

- 11.1.5 Root and tuber crops
- 11.1.6 Vegetable crops
- 11.1.7 Spice crops
- 11.1.8 Fruit crops
- 11.1.9 Plantation crops
- 11.1.10 Flower crops
- 11.1.11 Fodder crops
- 11.2 Fertilizer recommendation for cropping patterns in different AEZs
- 11.3 Fertilizer recommendation for multiple cropping systems

12. APPENDICES

- 12.1 Trend of fertilizer use in Bangladesh
- 12.2 Nutrient composition of fertilizers
- 12.3 Maximum allowable limits of different toxic metals in chemical and organic fertilizers
- 12.4 Nutrient composition of manure/materials
- 12.5 Nutrient composition of green manures and crop residues
- 12.6 Nutrient supply from organic materials
- 12.7 Inoculant and seed requirement of different legumes
- 12.8 Interpretation of soil test values based on critical limit
- 12.9 Location specific and yield goal basis fertilizer recommendation for crops based on soil test values
- 12.10 Site specific fertilizer recommendation for crops and cropping patterns on the basis of soil test, yield goal and rationales
- 12.11 Symbols and atomic weights of some elements
- 12.12 Useful chemical conversion factors
- 12.13 Some useful conversion factors
- 12.14 Classification of soils on the basis of organic matter content and cation exchange capacity
- 12.15 Classification of soils on the basis of soil pH values
- 12.16 Classification of soils on the basis of soil salinity values
- 12.17 Classification of land type
- 12.18 Available forms of plant nutrients
- 12.19 Methods of soil sample collection

13. MAPS

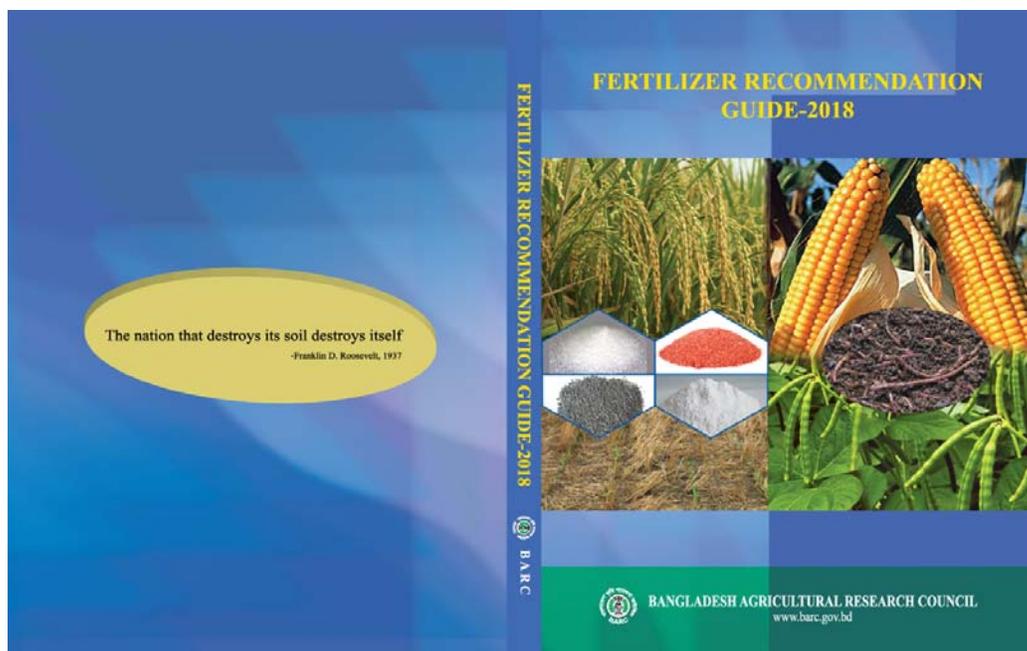
- 13.1 AEZs of Bangladesh
- 13.2 Land types of Bangladesh
- 13.3 Soil pH status of Bangladesh soils
- 13.4 Organic matter status of Bangladesh soils
- 13.6 Soil P status in Bangladesh
 - 13.7 Soil K status in Bangladesh
- 13.8 Soil S status in Bangladesh
- 13.9 Soil Zn status in Bangladesh
 - 13.10 Soil B status in Bangladesh
- 13.11 Soil salinity in Bangladesh

14. ABBREVIATION

It is evident from the above list that in the text part of English version of FRG-2018 the major contents are introduction, plant nutrients, mineralogy and soil fertility status of different AEZs of

Bangladesh, soil fertility evaluation, fertilizers and their use, soil organic matter management, soil acidity and liming, fertilizer management for different farming systems, fertilizer management in degraded land farming and quality control of fertilizers.

In the fertilizer recommendation part, a total of 475 fertilizer recommendations have been made in FRG-2018, of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping. Soil test based fertilizer recommendations have been made for single crops like cereal crops, fiber crops, pulse crops, oilseed crops, root and tuber crops, vegetable crops, spice crops, fruit crops, plantation crops, flower crops, fodder crops, and AEZ based fertilizer recommendations for the existing major cropping patterns and multiple cropping. On the other hand fertilizer recommendation for local improved varieties (LIVs) and low yielding varieties of different crops and tobacco (included in FRG-2012) have been discarded. FRG-2018 also includes 19 appendices and 11 maps on different aspects of soil fertility and fertilizer management in FRG-2018.



Cover page of English version FRG-2018

Differences between FRG-2012 and FGR-2018:

There are some major differences between FRG-2012 and FRG-2018 in respect of contents and information. In FRG-2018 some contents were newly added and some were modified, improved, replaced and some were discarded both in text part and fertilizer recommendation part. In the text part major inclusions are the new chapters on soil conditions causing nutrient deficiency of crops, nutrient absorption and translocation, soil acidity and liming, fertilizer management for multiple cropping systems, conservation agriculture, homestead gardening, roof top gardening, floating agriculture etc. It also includes fertilizer management for degraded land farming like hill farming, coastal farming, haor farming and charland farming. On the other hand, some chapters like nutrient availability in soils, soil erosion, soil salinization, water-logging of soil, soil fertility depletion, heavy metals and contamination of soils, use of Upazila Nirdeshika for making location specific fertilizer recommendation, and trends in fertilizer nutrient use in some selected South and Southeast Asian countries (which were included in FRG-2012) have been discarded.

In the fertilizer recommendation part, a total of 475 fertilizer recommendations have been made in FRG-2018 of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping compared to a total of 459 recommendations in FRG-2012 comprising of 155 for single crops, 297 for the cropping patterns and 23 for multiple cropping. Fertilizer recommendations for five crops like dragon fruit, star goose berry, fig, Indian olive and sugar beet were new addition in FRG-2018. Fertilizer recommendations have been made for most of the new varieties of different crops developed during the last five years. On the other hand fertilizer recommendations for Local Improved varieties (LIVs) of different crops and tobacco were discarded. There are also major differences in cropping patterns between FRG-2018 and FRG-2012 and their fertilizer recommendations. All the major cropping patterns presently

existing in field have been included in FRG-2018; and many cropping patterns (CPs) that presently covering minor areas (which were previously major CPs and included in FRG-2012) have been discarded.

Changes in Soil Organic Matter, soil pH and Soil Fertility:

A good soil should have at least 2.5% organic matter, but in Bangladesh most of the soils have less than 1.5%, and some soils have even less than 1% organic matter. As the time advances, organic matter content in soil declines. This is particularly true under high land and medium high land conditions. The long-term fertilizer trials indicate that in the rice-rice (anaerobic-anaerobic) cropping system, the soil organic matter has slightly increased (BRRI and BAU reports) and in the wheat-rice (aerobic-anaerobic) system the soil organic matter has rather decreased (BARI report). Hence, depletion of soil organic matter cannot be generalized across the country.

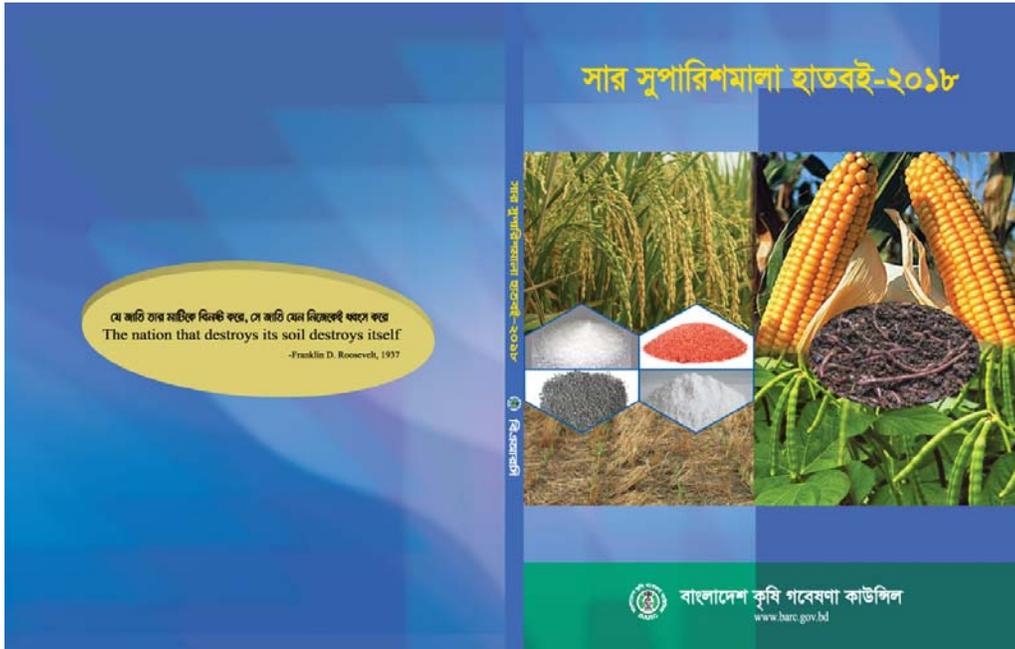
Soil pH and soil fertility, were found to follow decreasing trend almost throughout the country, which might be due to use of high doses chemical fertilizers. The potassium content of soil was also found to follow decreasing trend almost throughout the country. Because potassium is taken up by the crops in highest amounts. However, the phosphorus content of soil was found to have increasing trend. Zinc and sulphur content of soil is more or less static over time. However, sulphur content in soil was found have slightly increasing trend around the industrial areas. Boron deficient areas in the country is gradually increasing.

Contents of Bengali version of FRG “mvi mycvwikgvjv nvZeB-2018Ó

As also mentioned before that the FRG-2018 have been published in Bengali as “mvi mycvwikgvjv nvZeB-2018Óin addition to English version of “Fertilizer Recommendation Guide-2018”. The Bengali version, “mvi mycvwikgvjv nvZeB-2018Óis not the as such translation of the English version. There are major differences in the contents of English and Bengali versions. As of the English version the Bengali version “mvi mycvwikgvjv nvZeB-2018Óalso has two major parts, the text part and the fertilizer recommendation part. The content of the English of “mvi mycvwikgvjv nvZeB-2018Óis as follows:

1. fzwgKv
2. Dw™Ç` cywó Dcv`vb
3. mvi l Gi †kÖYx wefvM
4. mv‡i we`g vb cywó Dcv`vb
5. dm‡j cywó Dcv`v‡bi AfveRwbZ jÿYmgyn
6. gvwUi De©iZv
7. gvwUi ^Re c`v_© e`e`vcbv
 - LvgvRvZ mvi
 - K‡xúv÷ mvi
 - dm‡ji cwiz`³ Ask
 - fvwg©-K‡xúv÷ ev †Ku‡Pv mvi
 - U³vB‡Kv-K‡xúv÷

- ev†qv-øvix mvi
meyR mvi
8. AYyRxe mvi
 9. mvi e"e"vcbv
 10. mvi cÖ†qv†M we†eP" welqmgyn
 11. gvV ch©v†q †fRvj mvi mbv³KiY c×wZ
 12. K...wl cwi†ek AÂj
 13. mvi cÖ†qv†Mi mgq l c×wZ
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 15. K...wl cwi†ek AÂj Abyhvqx dmjaviv wfwËK mvi mycvwikgvjv
 16. GKK dmj wfwËK mvi mycvwik
 17. dj dm†ji mvi mycvwikgvjv
 18. cwiwkó-1: f~wg †kÖwY
 19. cwiwkó-2: evwbwR"K wfwË†Z Drcv`b l evRviRvZKi†Yi Rb" miKvi KZ©„K
Aby†gvw`Z ^Re mv†ii MVb
 20. cwiwkó-3: Conversion factors
 21. cwiwkó-3: K...wl cvi†ek AÂ†ji gybwPÍ



Cover page Bengali version of FRG-2018

It is evident from the above content list of “mvi mycvwikgvjv nvZeB-2018Óthat the text part includes major chapters on introduction, plant nutrients, classification of fertilizers, nutrient contents in fertilizers, nutrient deficiency symptoms in plants, soil fertility, soil organic matter management, fertilizer management, major considerations during fertilizer application,

identification of adulterated fertilizers at farm level, AEZs of Bangladesh, time and methods of fertilizer application etc.

The fertilizer recommendation part of “mvi mycvwikgvjv nvZeB-2018Ó is similar to that of the English version of “Fertilizer Recommendation Guide-2018”. A total of 475 fertilizer recommendations have been made in “mvi mycvwikgvjv nvZeB-2018Ó, of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping. Fertilizer recommendations have been made for all most all the major crops and new varieties of different crops developed during the last five years. Fertilizer recommendations for all the major cropping patterns presently existing in field have been included in “mvi mycvwikgvjv nvZeB-2018Ó. For easy calculation of fertilizers by the farmers for a particular plot the fertilizer nutrients (eg. N, P, K etc.) have been converted into fertilizer product (eg. Urea, TSP, MoP etc.) and their rate of application has been made as kg of fertilizer/decimal.

Difference in contents between English and Bengali version of FRG-2018

There are some major differences between the English and Bengali versions of FRG-2018 in respect of contents. In the text part of Bengali version only some basic information on plant nutrition, fertilizer management, method of fertilizer application, identification of adulterated fertilizer at the farm level etc. useful for the farmers have been included. While the English version many chapters on the theories and principles of soil fertility and fertilizer management, land degradation, rationale of fertilizer use, quality control of fertilizers etc. useful for the scientists, professionals and academicians have been included in the text part in addition to the above mentioned chapters of Bengali version. In the fertilizer recommendation part, same fertilizer recommendations have been provided for different crops, cropping patterns and multiple cropping both in English and Bengali versions but the units of rate of application of nutrients is different. In the English version the unit for rate of application of nutrient is expressed as “kg of nutrient/ha” but in Bengali version the unit is “kg of fertilizer/decimal”. The Bengali version contains only four appendices and one map on different aspects of soil fertility and fertilizer management, while the English version contains 19 Appendices and 11 maps.

12. Research Highlights/findings (Bullet point – max 10 nos.):

- 1) FRGs have been published in English as “Fertilizer Recommendation Guide-2018” and in Bengali as “mvi mycvwikgvjv nvZeB-2018Ó.
- 2) On-line and off-line versions of “mvi mycvwikgvjv nvZeB-2018Ó have been developed and made available in BARC website and as mobile app.
- 3) A total of 475 fertilizer recommendations have been made both in English and Bengali versions of FRG-2018, of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping.
- 4) Most of the agricultural soils of Bangladesh have less than 1.5%, and some soils have even less than 1% organic matter. The organic matter content in soils is gradually declining, particularly under high land and medium high land conditions. The major

causes of depletion are intensive use of land, less use of organic manure, less or no retention of crop residues in the field etc.

- 5) The long-term fertilizer trials indicate that in the rice-rice (anaerobic-anaerobic) cropping system, the soil organic matter has slightly increased (BRRI and BAU reports) and in the wheat-rice (aerobic-anaerobic) system the soil organic matter has rather decreased (BARI report). Hence, depletion of soil organic matter cannot be generalized across the country.
- 6) Soil pH was found to have decreasing trend almost throughout the country, which might be due to use of high doses chemical fertilizers.
- 7) The potassium content of soil was also found to have decreasing trend throughout the country, which might be due highest uptake of the nutrient by crops. But the phosphorus content of soil was found to have increasing trend. Zinc and sulphur content of soil is more or less static over time. Sulphur content in soil was found have slightly increasing trend around the industrial areas. Boron deficient areas in the country is gradually increasing.
- 8) Use of urea fertilizer in the country is almost static during the last 15 years, while the use of other fertilizers like TSP, DAP, MoP and zinc sulphate is gradually increasing. This might be due to the effect of subsidy policy of the Govt. on different fertilizers and gradual up gradation of farmers' knowledge on fertilizer use. This indicates that the farmers of the country are gradually moving towards balance use of fertilizers.

B. Implementation Position

1. Procurement

Description of equipment and capital item	PP Target		Achievement		Remarks
	Phy (#)	Fin (Tk.)	Phy (#)	Fin (Tk.)	
a) Office equipment (Lap top)	1	55,933	1	55,933	
b)					
c)					

2. Establishment/renovation facilities: N/A

Description of facilities	Newly established		Upgraded/refurnished		Remarks
	PP Target	Achievement	PP Target	Achievement	
a) -	-	-	-	-	-
b)					
c)					
d)					
e)					

3. Training/study tour/seminar/workshop/conference organized: N/A

Description	Number of participant			Duration (days/weeks/months)	Remarks
	Male	Female	Total		
a) Training	-	-	-	-	-
b) Workshop (2 nos.)	130	10	140	1 day (each)	

C. Financial and Physical Progress
Fig. in Tk

Items of expenditure/activities	Total approved budget	Fund received	Actual expenditure	Balance/ unspent	Physical progress (%)	Reasons for deviation
A. Contractual Staff Salary	250023	250023	250023	0	100	
B. Field Research / Lab expenses and supplies	0	0	0	0	-	
C. Operating Expenses	90000	79927	79927	0	100	
D. Vehicle Hire and Fuel, Oil & Maintenance	50000	50000	50000	0	100	
E. Training/Workshop/ Seminar etc.	610000	406400	406400	0	100	
F. Publications and printing	3505977	1803456	1803456	0	100	
G. Miscellaneous	372000	394261	394261	0	100	
H. Capital Expenses	60000	55933	55933	0	100	
Grand Total	4938000	3040000	3040000	0	100	

D. Achievement of Sub-project by objectives: (Tangible form)

Specific objectives of the Sub-project	Major technical activities performed in respect of the set objectives	Output (i.e. product obtained, visible, measurable)	Outcome (short term effect of the research)
Updating of fertilizer recommendation for crops and cropping patterns under different Agro-ecological Zones (AEZs)	<ul style="list-style-type: none"> Collected updated information on AEZ wise soil fertility status and existing cropping patterns at farm level ;and fertilizer recommendations for different crops, cropping patterns and multiple cropping from different NARS institutes and DAE etc. The information were validated, compiled and edited in the Editorial Board meetings and the draft manuscript of the updated FRG-2018 was prepared. Two separate workshops were organized on draft English and Bengali FRGs. Suggestions and comments from the workshops were incorporated to finalize the FRG-2018. A software company was hired 	<p>Collected information from different NARS institutes and DAE have been preserved in office files.</p> <ul style="list-style-type: none"> Attendance of Editorial Board meetings and draft manuscript of the updated FRG-2018 have been preserved in office files. Attendance of participants and recommendations of the workshop have been preserved in office files. Office records for 	

	to prepare the on-line and off-line version (as mobile apps) of “mvi mycvwikgvjv nvZeB-2018Ó.	hiring Software Company for preparing the on-line and off-line version (as mobile apps) of “mvi mycvwikgvjv nvZeB-2018Ó.	
Publication of the updated FRG	<ul style="list-style-type: none"> The draft manuscript of the English and Bengali versions of updated FRGs-2018 were finalized with incorporation of suggestions, comments and recommendation of the workshops. The updated and edited manuscripts were printed and published. Web application: frg.barcapps.gov.bd Mobile apps: frg.barcapps 	<ul style="list-style-type: none"> Two publications of updated FRGs-2018 in English and Bengali. Web application: frg.barcapps.gov.bd Mobile apps: frg.barcapps 	The updated FRGs-2018 will contribute towards balanced use of fertilizers and sustainable crop production in the country.

E. Material Development/publication made under the Sub-project:

Publication	Number of publication		Remarks (i.e. paper title, name of journal, conference name etc.)
	Under preparation	Completed & published	
Two books on updated FRG has been published in English as “Fertilizer Recommendation guide-2018” and in Bengali as “mvi mycvwikgvjv nvZeB-2018Ó.	-	2	Fertilizer Recommendation guide-2018, and mvi mycvwikgvjv nvZeB-2018
<ul style="list-style-type: none"> Web application: frg.barcapps.gov.bd Mobile apps: frg.barcapps 	-	2	<ul style="list-style-type: none"> Web application: frg.barcapps.gov.bd Mobile apps: frg.barcapps
Technology bulletin/booklet/leaflet/flyer etc.	-	-	-
Journal publication	-	-	-
Information development	-	-	-

F. Technology/Knowledge generation/policy support (as applied):

i. Generation of technology:

Fertilizer recommendations for different crops and cropping patterns developed by different NARS institutes during 2011 to 2017 have been compiled and edited to prepare Fertilizer Recommendation Guide-2018 (English version) and mvi mycvwikgvjv nvZeB-2018(Bengali version).

ii. Generation of new knowledge that help in developing more technology in future ---

iii. Technology transferred that help increased agricultural productivity and farmers income

A total of 475 fertilizer recommendations have been included both in English and Bengali versions of FRG-2018, of which 155 are for single crops, 297 are for the cropping patterns and 23 are for multiple cropping. The FRGs-2018 containing updated fertilizer recommendations for different crops, cropping patterns and multiple cropping will contribute towards balanced use of fertilizers, increased agricultural productivity and farmers' income.

iv. Policy support

Fertilizer Recommendation Gide is considered as the national document on fertilizer recommendation for different crops, cropping patterns and multiple cropping of the country. The FRG is used as the basis for development of research and development programs on soil fertility and fertilizer management and agricultural production planning and implementation at the national and local levels of the country.

G. Information regarding desk and field monitoring

i) Desk monitoring (description and output of consultation meeting, monitoring workshop, seminar etc.)

Two workshops were organized on draft English and Bengali versions of FRGs. The draft FRGs on English and Bengali versions were presented in the workshops. A total of 80 participants from different NARS institutes, DAE, BADC, IFDC, KGF, agricultural universities, Dhaka University and senior scientists, professionals and farmers attended in each workshop. Comments and suggestions from those workshops were incorporated in the draft FRGs for improvement. Besides, 24 meetings of Editorial Board were held for compilation and editing the FRG-2018.

ii) Field monitoring (time and number of visit, Team visit and output:Not applicable

H. Lesson learned/Challenges (if any)

- i) Collection of information from secondary sources is a very difficult and challenging job
- ii) Validation of information is a critical job
- iii) Compilation of information is also a very sensitive and tedious job

I. Challenges (if any)

The project period was only one year. Two versions of FRG-2018, English (223 pages) and Bengali (113 pages) have been published; and web application (frg.barcapps.gov.bd) and mobile apps (frg.barcapps) have been developed for the Bengali version “mvi mycvwikgvjv nvZeB-2018” within this short period of time. The FRGs have been updated and published with the information generated by the NARS institutes, DAE and universities. Collection of information, validation, compilation, editing and printing of FRG-2018 within a year was really a challenging job.

Signature of the Principal Investigator

Date:

Seal

Counter signature of the Head of the
Organization/authorized representative

Date:

Seal

Acknowledgement

The CRG sub-project on “Updating of Fertilizer Recommendation through Interpretation of Research Results Generated by the NARS Institutes” has been completed successfully with the research grant of USAID Trust Fund and GoB through Ministry of Agriculture. We would like to thank World Bank for arranging the grant fund. Thanks to PIU-BARC, NATP-2 for their sincere cooperation, efficient management and timely release of fund when need. The Editorial Board members deserves special thanks for their sincere and untiring efforts and contribution for timely publication of the updated version of Fertilizer Recommendation Gide-2018 in English and Begali; and also for the contribution to the development of web application (frg.barcapps.gov.bd) and mobile apps (frg.barcapps) of the Bengali version of FRG-2018. Special thanks to BARC authority for all out cooperation and help to complete the project successfully and publication of the Fertilizer Recommendation Gide-2018.

Expert comments/suggestions

SI#	Title of the CRG Sub-project and PI/Presenter	Comments & Suggestions
1.	<p>ID 666: Updating of Fertilizer Recommendation through Interpretation of Research Results Generated by the NARS Institutes</p> <p>PI/Presenter: Dr. Md. Abdus Satter Former CSO (Soils), NRM Division, BARC, Farmgate, Dhaka-1215</p>	<ul style="list-style-type: none"> • Updating and publication of FRG-2018 which is a mandate of BARC, the PI and his associated members accomplished the task very nicely • A good number of chapters have been included in FRG-2018 which deserves appreciation especially, inclusion of carbon sequestrations in soil organic management (chapter 6), Fertilizer management for conservation agriculture, roof top gardening, floating bed, organic farming etc. • Keeping in mind about the interest of farmers of using fertilizer in kg/decimal rather than in kg/ha. • It would be wise if the authors show how the bio-slurry could be used for conservation of GIS/BIO-Gas plant for the progressive farmers for use in their houses. • evsjvq Ómvimycvwikgvjv nvZeB-2018 mwZ`B GKwU my`i I if c`ÿc, GB eBwU †hb K...l†Ki nv†Z †cŠ†Q Zv wbwðZKi†Z n†e This Book needs to be distributed among the progressive farmers especially Block/Community Based farmers as well as upto Union Parishad level which to be ensured by the authority