Annexes

Annex 1: Summary of Group Discussions

Tasks

- Summarise major findings and make recommendations
- Identify important issues
- Develop outline for future study (Brief PCN)

Group A: Human nutrition
Group B: Soil/plant interaction
Group C: Soil nutrient management/Soil mapping

Group A: Human nutrition

Major findings, recommendations, and issues

- Many findings were described in the workshop. The major finding is that agriculture and nutrition are closely linked. Throughout the workshop, new knowledge was gained from and by the participants.
- Education and awareness: the role of micronutrients in human health is vital and rural poor communities need to receive this knowledge.
- Nutrient providers are none other than the 'farmers', so we should educate and mobilise them.
- There is a lot of discrete knowledge; everything needs to be put in a concise way to lead to an outcome, maybe in the form of a programme or policy.
- Knowledge has not yet been made available or acceptable to the farmers.

Future plans/studies

- Constitute a working group that involves agriculture, nutrition, and health department people.
- The working group should come up with a plan that identifies/addresses the problems pertaining to the area.
- The working group should consider policy makers, education, and training, and this should be followed up by a case study.
- Finally the organisations interested should develop strategies and objectives to achieve nutritional security and form a work plan.

Group B: Soil/plant interaction

Findings

- Zn, B, Mo, and Fe deficiency is widespread in most of the soils of India, Nepal, Bangladesh, and Pakistan. B and Mo deficiency are particularly common in acidic soils, and Zn deficiency in most rice soils.
- Grain legumes respond to Zn, B, Fe, and Mo in most of the deficient soils in India, and toria responds to B, Zn, and Mo in sandy loam acidic soils of Nepal.
- In India, aromatic rice responds to Zn.
- B-efficient cultivars have been identified for cultivation in the B-deficient soils of Nepal.
- Priming of chickpea seeds with *Rhizobium* and Mo in west Bangladesh and eastern

India, and priming of wheat and chickpea seed with Zn in Pakistan, proved effective in correcting the deficiency of Mo and Zn.
- Se deficiency in goats caused infertility in Nepal.

Recommendations

- In general, soil application of Zn and B, and foliar sprays of Mo and Fe, at recommended rates and timed effectively to compensate for the deficiency are recommended.
- Use of enriched seeds either by seed priming or use of mother seed can be cost effective for resource-poor farmers.
- Micronutrient deficient cultivars having high-yield potential can be recommended wherever they have been identified.
- Use of organic manure is recommended wherever available to reduce micronutrient deficiency.
- Foliar application to a strip of crops in a farmer's field for a suspected micronutrient deficiency may be used as a diagnostic tool for identifying a nutrient deficiency disorder.

Future Studies

- Development or identification of micronutrient efficient and Fe and Al tolerant cultivars
- Synergistic and antagonistic interactions of nutrients in areas of multiple deficiencies in order to optimise rates of application
- Micronutrient requirements for important cropping systems as a whole
- Role of organics in supplementing micronutrients in important cropping systems
- Characterisation and publication of deficiency symptoms of micronutrients in important crops of the region
- Se deficiency status of soils, plants, and water in areas where deficiency is suspected
- Trace element deficiency and toxicity in the soil-plant-animal-human chain

Group C: Soil nutrient management/Soil mapping

Mapping

- Develop regional/country maps for micronutrient status, crop responses, indigenous knowledge, human and animal deficiencies, and other related factors
- Develop maps suitable for extension purposes and government/policy makers/planners
- Prioritise mapping according to economic importance and human health values for micronutrients and micronutrient impacts, particularly for Zn, B, Mo, and Se

Important issues identified

- Adaptive micronutrient research suitable for resource poor farmers, through research outreach programmes/extension and development stakeholders
- Adaptive research programmes should use participatory approaches with special emphasis on poor farmers
- Training for agricultural stakeholders based on adaptive research results; stakeholders include input suppliers, farmers, and development workers with the knowledge

Prioritise activities across research problems

- Human health should also be considered when making recommendations

- Recommendations should be specific for ecosystem diversities
- Prioritisation of adaptive research issues based on economic modelling that includes human health costs, crop returns, sustainability, probability of success, and others

Identify appropriate micronutrient management options

- Management of organic inputs/FYM, crop residues
- Inorganic inputs: soil application
- Foliar spray
- Seed treatment: seed priming, seed enrichment
- Agronomic management, e.g., water management in rice
- Use of efficient crop varieties, rotations, and *Rhizobium*

Communication strategy

- Develop mechanisms to link different aspects of micronutrient research in relation to crop, animal, and human health activities
- Develop communication systems for sharing knowledge and experiences between regions, countries, institutions, and research and development workers across disciplines
- Identify contact persons from each country and institution for future communication
- Identify a regional coordinator/facilitator or a leading institute for future programme development

Programme development strategy

- Quantify benefits of micronutrient research and development as the basis for justifying programmes to donors
- In the development funding strategies, emphasise the impact on human welfare and the consequences of failure, act now to address micronutrient deficiencies
- Document successful impacts on poor rural populations of micronutrient R&D programmes

Miscellaneous

- Develop and strengthen the supply chain with quality control of micronutrient products and technologies by working with the private sector
- Develop regional and national research capacities to address micronutrient research issues/problems efficiently

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Micronutrients are elements that are needed by plants, animals, and human beings in minute quantities, but their presence is essential for health. Increasingly, Asian soils and food are affected by micronutrient disorders, leading to reduced crop yields and malnutrition. In this book, international researchers present problems and solutions.

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