

### *Recommendations of the Workshop*

A survey was conducted with a very brief questionnaire to all the participants of the workshop. The objective of the survey is to determine the future research and development needs for mungbean and to ascertain the constraints to promotion of improved mungbean varieties in the Indo-Gangetic Plains of South Asia with emphasis on Bangladesh, India and Nepal. The participants came up with the following recommendations:

1. Varietal development and agronomic research on mungbean should focus on extra short duration varieties and resource conserving environment friendly management technologies that will reduce cost of production.
2. Among the biotic constraints, in-depth research is most needed on mungbean yellow mosaic virus (MYMV) and pod borer. Research should focus on durable resistance, marker-assisted selection, and diversity of virus strains. In addition to MYMV, studies on *Cercospora* leaf spot, root disease complex, and powdery mildew resistance are also important. In addition to pod borer, studies on whitefly and weevil control are also needed.
3. Yield potential in farmer's field should be stabilized and enhanced. Constraints to stable and high yield should be carefully evaluated and solutions for the same should be identified.
4. Agronomic research should focus on location- and season-specific management practices that can enhance yield, reduce cost of production, sustain soil productivity, and conserve the environment.
5. Efforts should be made to develop improved cultivars that can withstand drought and adverse weather conditions for use in marginal, dry and semi-arid situations.
6. The need to have further socio-economic and marketing research was emphasized. The farmer's organization was concerned with the unstable and low prices for mungbean. Therefore, the government should come up with positive policy guidelines and guarantee prices for mungbean, which will stimulate and encourage farmers to diversify the rice-wheat system with mungbean. Without government policy and price support system, farmers may be reluctant to change even though the yield is attractive and crop duration is short and optimized for adoption by farmers in the region.

7. Farmers and consumers prefer large shiny seeds for the market since they fetch a premium price. Therefore, new varieties to be produced should be bold and shiny.
8. Uniform maturity is attractive and desirable for the farmers in crop diversification since they can use machines to harvest the crop. Therefore, varieties with synchronized maturity are preferable.
9. The Seed Village Program is excellent and it should be extended to other countries.
10. The dramatic expansion of area and production of mungbean in Punjab and Bangladesh should be extended to poor states such as Bihar and Rajasthan and to the poor farmers in Nepal.

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***Appendix 1. Acronyms***

Ai	adoption index
AICPIP	All India Coordinated Pulses Improvement Project
AICRP	All India Coordinated Research Programme
AMVT	Asian Mungbean Varietal Trials
ANOVA	analysis of variance
APP	agriculture perspective plan
ARA	acetylene reduction activity
AVRDC	Asian Vegetable Research and Development Center- The World Vegetable Center
AVT	advanced varietal trial
BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agricultural Research Institute
BINA	Bangladesh Institute of Nuclear Agriculture
BLS	Bacterial Leaf Spot
BMI	Body Mass Index
BNF	biological nitrogen fixation
BSMRAU	Bangabhandhu Sheikh Mujibur Rahman Agricultural University
BT	Baby Trials
CAZS	Centre for Arid Zone Studies
CIMMYT	International Maize and Wheat Improvement Center
CLS	<i>Cercospora</i> leaf spot
CVRC	Central sub committee on crop standards, notification and release of variety
DAA	day after anthesis
DADOs	District Agriculture Development Offices
DAE	Department of Agricultural Extension
DAP	Diammonium phosphate
DFID	Department for International Development
DM	dry matter
FLD	front line demonstrations
FORWARD	Forum for Rural Welfare and Agricultural Reform for Development
FPP	Full Package of Practice
HAS	hours after sowing
HAU	Haryana Agricultural University
IARC	International Agricultural Research Centers
IARI	Indian Agricultural Research Institute

ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFFCO	Indian Farmers Fertilisers Cooperative Limited
IGP	Indo-Gangetic Plains
IMN	International Mungbean Nursery
IRD	Informal Research and Development
KAP	knowledge, attitude and practice
<i>Kharif</i>	rainy season
<i>Kharif I</i>	March-May
<i>Kharif II</i>	August-November
LBMDDP	Lentil, Blackgram Mungbean Development Pilot Project
LI-BIRD	Local Initiatives for Biodiversity Research and Development
Mo	Molybdenum
MPN	Most Probable Number
MT	Mother Trials
MYMV	mungbean yellow mosaic virus
N	nitrogen
NARC	Nepal Agricultural Research Council
NBPGR	National Bureau of Plant Genetic Resources
NGLRP	The National Grain Legumes Research Programme
NIAB	Nuclear Institute for Agriculture and Biology
NIFA	Nuclear Institute for Food and Agriculture
NPK	Nitrogen/Phosphorus/Potassium
NRRP	National Rice Research Program
NSC	National Seed Corporation
NWFP	Northwest Frontier Province
NWFPAU	Northwest Frontier Province Agricultural University
NWPZ	north west plain zone
P	phosphorus
PAU	Punjab Agricultural University
PGPR	plant growth promoting rhizobacteria
PSB	phosphate solubilizing bacteria
PSSC	Punjab State Seeds Corporation
PSSCA	Punjab State Seed Certification Authority
PUNSEED	Punjab State Seed Corporation
Pusa Vishal	Pusa Bold
PVS	participatory varietal selection
R	<i>Rhizobium</i>
<i>Rabi</i>	winter
RCBD	Randomized Complete Block Design
RDA	recommended dietary allowances
RDI	recommended dietary intakes

RF	recommended fertilizer
RH	relative humidity
S	sulphur
SAR	Systemic Acquired Resistance
SAVERNET	South Asian Vegetable Research Network
SFCI	State Farm Corporation of India
SSCs	State Seeds Corporations
SSP	single super phosphate
STL	Seed Testing Laboratory
SVAC	State Variety Approval Committee
SVP	Seed Village Programme
TNAU	Tamil Nadu Agricultural University
TR	traditional preparation
U.P.	Uttar Pradesh
UPGMA	unweighted pair group method analysis
WHO	World Health Organization
YEMA	yeast extract mannitol agar

## ***Appendix 2. Project Background***

Under the umbrella framework of South Asia Vegetable Research Network (SAVERNET), a mungbean subnetwork was initiated in March 1997. The Department for International Development (DFID) of U.K. approved a three-year Holdback Project R6719 (H), “Promotion of Mungbean Research Outputs for Farmer Adoption in South Asia”. A total of 31 promising cultivars from the six participating South Asian countries (Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka) and AVRDC were pooled together for conducting uniform trials. The project conducted trials in 16 strategic locations in Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka for two seasons in 1998 and 1999. From the results of the trials, Bangladesh, Pakistan and India have identified cultivars that are resistant/tolerant to mungbean yellow mosaic virus (MYMV) and yield 2 t/ha in 55–65 days after sowing. Bhutan and Sri Lanka identified cultivars with more than 2 t/ha in the absence of MYMV. The Indian Agricultural Research Institute and G.B. Pant University of Science and Technology in India have officially released NM-92, NM-94 and VC 6368 as Pusa Vishal, SML 668 and Pant Mung 5, respectively. Bangabandhu Sheikh Mujibur Rahman Agricultural University in Bangladesh has released VC 6372(45-8-1) as BUMug 1 and VC 6370(30-65) as BUMug 2. Bangladesh Agricultural Research Institute has released NM-92 as BARImung 5.

DFID recognized the potential of the above short maturity duration (55–65 days), MYMV resistant, synchronously maturing, bold seeded, high yielding mungbean cultivars for diversifying the Rice Wheat Cropping System (RWC) for millions of small farmers in the Indo-Gangetic Plains of South Asia (specifically Bangladesh, India and Nepal). They approved a two-year project in March 2002, “Improving Income and Nutrition by Incorporating Mungbean in Cereal Fallows in the Indo-Gangetic Plains of South Asia”.

### **Project Goals**

- Improved rural household income and employment opportunities, increased nutritional security and diversified healthy diets through increased availability of mungbean for the poor in the Indo-Gangetic Plains
- Enhanced soil fertility for 500,000 farmers in the Indo-Gangetic Plains of South Asia

### **Project Objectives**

- Farmers in the Indo-Gangetic Plains adopt and integrate MYMV resistant/tolerant, short duration mungbean cultivars in RWCs for diversification and sustainability of the cereal-based cropping system.
- Collaborating national agricultural research systems (NARS) utilize AVRDC's improved mungbean germplasm and methodologies for location-specific adoption, considering socio-economic conditions and constraints of farmers in the Indo-Gangetic Plains.
- Mungbean consumption in South Asia is promoted for improved diets.

### **Research Activities**

1. Socio-economic analysis
2. Cultivar identification
3. Technology packages development
4. Evaluation of the effect of mungbean on cereals
5. Determination of water use efficiency
6. Seed production and distribution
7. Recipes development
8. Impact assessment

The outputs of the above activities will be presented and discussed. Participants will also discuss a follow-up plan for the next two years to expand the area and production of mungbean and to conduct research to overcome the constraints.

**Appendix 3. Workshop Program, 27-31 May 2004**

<b>Day 1 – 27 May 2004 (Thursday)</b> Arrival of participants and registration		
<b>Day 2 – 28 May 2004 (Friday)</b>		
0830-0900	Registration	
<b>Session I. Opening Ceremonies</b>		
0900-1000	Welcome	G.S.Nanda, D.R./ PAU
	Introduction to Workshop	S. Shanmugasundaram, DDG-R/ AVRDC
	Keynote address	G. Kalloo, DDG (Hort. & CS)/ ICAR
	Address by Chief Guest	Thomas A Lumpkin, DG, AVRDC
	Presidential remarks	K.S. Aulakh, VC/PAU
	Vote of thanks	M.S.Tiwana, Dean, College of Agriculture, PAU
1000-1030	Group picture	
1030-1100	Coffee break	
<b>Session II. Final Report – Bangladesh</b> <b>Chairman: N.B. Singh</b> <b>Reporteur: George Kuo</b>		
1100-1120	Development of short duration mungbean cultivars for rice-based cropping systems in Bangladesh	Md. Moynul Haque
1120-1140	Research on agronomic practices for mungbean in rice-based cropping system in Bangladesh	Abdul Hamid
1140-1200	Effect of mungbean on the productivity in rice-wheat cropping system	Abdul Hamid
1200-1220	Mungbean diseases and pests incidence and their management	Md. Abu Bakr
1220-1240	Seasonal variation in seed quality of two improved mungbean varieties	Md. Moynul Haque



1240-1300	Adoption and seed production mechanisms of modern varieties of mungbean in Bangladesh	Md. Ali Afzal
1300-1400	Lunch	
1400-1430	Economics of mungbean cultivation in Bangladesh	Katinka Weinberger <i>et al.</i>
1430-1500	Discussion	
1500-1530	Coffee break	
<b>Session III. Final Report – India</b> <b>Co-Chairmen: Masood Ali and G.S. Nanda</b> <b>Reporteur: B.B. Singh</b>		
1530-1550	Developing short duration mungbean genotypes suitable for rice-wheat cropping system	J.S. Brar
1550-1610	Agronomic management in mungbean grown under different environments	H.S. Sekhon
1610-1630	Status of mungbean yellow mosaic virus resistance and characterization of viral strains by DNA markers	Gurdip Singh
1630-1650	Insect pest management of mungbean	B.S. Kooner
1650-1710	Status of production and distribution of mungbean seed in different cropping seasons	T.S. Bains
1710-1730	Role of Punjab State Seeds Corporation Ltd. (PSSC) in production and distribution of mungbean seed	Balbir Singh Sidhu
1730-1750	Socio-economic impact of new short duration mungbean varieties in Punjab	D.K. Grover
1750-1810	Development and impact of iron-rich mungbean recipes	Kiran Bains
1930	Welcome dinner hosted by AVRDC	

<b>Day 3 – 29 May 2004 (Saturday)</b>		
<b>Session III. Final Report – India (continue)</b>		
0810-0830	Seed production, distribution and extension of mungbean variety Pusa Vishal in different states of India	Naresh Chandra
0830-0850	Scope of mungbean [ <i>Vigna radiata</i> (L.) Wilczek] in Rajasthan, India: Technology and extension gaps in productivity	R.K. Siag and Vijay Parkash
0850-0910	Development of Pant Mung-5 and its potential expansion in Uttar Pradesh	D.P. Singh
0910-0930	Discussion	
<b>Session IV. Final Report – Nepal and others</b> <b>Co-Chairmen: Abdul Hamid and Raj K Gupta</b> <b>Reporteur: Dr. Gurdip Singh</b>		
0930-0950	Testing promotion of mungbean in cereal fallows in the low hills and <i>terai</i> agroecosystem of Nepal	Nithanand Khanal/ FORWARD
0950-1010	Development of mungbean [ <i>vigna radiata</i> (L.) Wilczek] varieties for rice and maize-based systems in Nepal	Rajendra Darai
1010-1030	Short duration mungbean in cereal-based cropping systems in farmer's field trials	R.K. Naresh
1030-1050	Mungbean production in the North West Frontier Province of Pakistan and the influence of on-farm seed priming	David Harris
1050-1120	Coffee break	
<b>Session V. Interaction with farmers</b> <b>Chairman: David Harris</b> <b>Reporteur: Katinka Weinberger/D.K.Grover</b>		
1120-1300	Interaction and discussion with mungbean growing farmers	
1300-1400	Lunch	

<b>Session VI. Opportunities for Mungbean Expansion</b> <b>Chairman: K.D. Joshi</b> <b>Reporteur: H.S. Sekhon</b>		
1400-1420	Transgenic route to develop MYMV resistant mungbeans	P.K. Jaiwal
1420-1440	Biological nitrogen fixation in mungbean: An overview	Poonam Sharma
1440-1500	Opportunities of extension in area and production of spring/ summer mungbean [ <i>Vigna radiata</i> (L.) Wilczek] in Haryana (India)	Ram Kumar
1500-1520	Prospects of mungbean in rice-wheat cropping systems in Indo-Gangetic Plain of India	Masood Ali
1520-1540	Opportunities for the cultivation of extra short duration of mungbean in the state of Tamil Nadu, India	A.R. Muthiah
1540-1600	Perspectives of RWC on the potential of mungbean in the rice-wheat system	Raj K. Gupta
1600-1620	Coffee break	
<b>Session VII. Proposed Workplan 2004–2006</b> <b>Chairman: Thomas A. Lumpkin</b> <b>Reporteur: S. Shanmugasundaram</b>		
1620-1730	Future plan preparation	
1730-1800	Closing remarks	
1930-	Farewell dinner	
<b>Day 4 – 30 May 2004 (Sunday)</b> Field trip to PAU farms and farmers' fields		
<b>Day 5 – 31 May (Monday)</b> Departure for participants		

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