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International Agricultural Research

MUNG CENTRAL

The IMIN is a collaboration between The World Vegetable Centre and international partners across Bangladesh, Myanmar, India and Australia to breed new mungbean lines with the hope of uncovering desirable traits for improved production across partner countries. This work is funded by the Australian Centre for International Agricultural Research (ACIAR).

Editorial

It's been some time since the last edition of Mung Central, and as you can imagine the project teams have been very busy completing project activities across the network. Many workshops have taken place in Myanmar, India and Thailand bringing together mungbean growers, seed companies, producers of pulse products and experts in mungbean research to discuss what are the challenges and priorities for mungbean improvement. The 10th of February was celebrated as 'World Pulses Day' and to mark the event our Indian partner at ICAR introduced the 'Mung Advisor' smartphone application designed to be a one-stop platform for farmers for all things on mungbean cultivation.

IMIN team won the WorldVeg Science excellence award for the work done on mungbean research, breeding and development. This is a massive achievement outlining almost 4 years of a collaborative efforts from all involved. If you are interested in finding out more about collaboration with the IMIN, please email: ramakrishnan.nair@worldveg.org.

We hope you enjoy this fifth edition of Mung Central. To access previous editions visit: www.aciar.gov.au/publication/Mung-Central-edition-four



Ram Nair receiving the WorldVeg Excellence award on behalf of IMIN – congratulations team!

The launch of Mung Advisor: Development of Android based application for farmers in India

Contributed by Aditya Pratap, Uma Sah, Sanjeev Gupta and N.P. Singh



Launch of Mung Advisor app by Shri. M. Venkaiah Naidu, Honourable Vice President of India

The number of farmers using smartphones in India is soaring. It is evident that there was a need for an information and communication technology (ICT) based platform for farmers, which could act as a one-stop solution to all their queries related to mungbean cultivation. The ICAR-Indian Institute of Pulses Research, Kanpur, developed an interactive application tool, "Mung Advisor" which is now available on Android smartphones through Google play store. This app is currently bilingual in English and Hindi and is free to download.

Mungbean is grown in three seasons across India viz., Spring/Summer, *Kharif* (Monsoon season) and *Rabi* (Winters)/rice fallow. This app covers all the three seasons and provides region- and season-specific information on improved varieties, cultural practices, insect-pest and disease management, post-harvest technology, marketing, etc. Mung Advisor also includes an automatic seed calculator to calculate the seed required per given area to obtain optimum plant stand. The app also provides information on plant architecture, weather advisories, latest statistics and nutritional profile of mungbean. The 'FAQs' section provides answers to all the commonly asked questions. Further, there is an option to interact with

experts in 'real time'. Mung Advisor was launched by the Hon'ble Vice-President of India, Shri M Venkaiah Naidu on 19 May, 2019 during the 24th 'Annual Group Meet of All India Coordinated Research Programme on Mungbean, Urdbean and Arid Legumes' held at Acharya NG Ranga Agricultural University (ANGRAU), Lam, Guntur, Andhra Pradesh, India, and was aired on a number of national electronic and print media. Supported by the ACIAR through International Mungbean Improvement Network (IMIN), this app will soon be upgraded to cover all the IMIN partner countries and be multi-lingual for each region.

To access Mung Advisor on Google Play go to this link:

<https://play.google.com/store/apps/details?id=com.mungadvisor&hl=en>

Study shows widespread adoption of WorldVeg mungbean lines in South Asia and Myanmar

Contributed by Pepijn Schreinemachers, WorldVeg South Asia

The World Vegetable Center conducted a study to quantify the adoption of improved mungbean varieties and agricultural practices in Bangladesh, India, Myanmar and Pakistan. Mungbean is grown on about 5.4 million ha in these countries. Mungbean farmers are generally unable to tell the name of variety they use as they use some of their own grain harvest as seed, or buy mungbean grains from the market for use as seed. The study, therefore, used a Delphi method in which local experts estimated varietal adoption rates, first individually and then as part of an expert panel. The study involved a total of 19 panels and 259 individual experts. The studies were locally

implemented by Teresa Sequeros in Myanmar, Saima Rani in Pakistan, Md. Abdur Rashid, Md. Shahrukh Rahman and Md. Razu Ahmed in Bangladesh, and Nithya Vishwanath Gowdru in India.

The results show that improved varieties are planted on 94% of the mungbean area in Pakistan, 87% in Myanmar, 81% in India, and 72% in Bangladesh. The table shows the five most important mungbean varieties per country. Breeding lines developed by the World Vegetable Center are widely used and account for 93% of the mungbean area planted in Pakistan, 77% in Myanmar, 27% in India, and 67% in Bangladesh. The study estimated that WorldVeg varieties are planted on 1.7 million ha of land and, based on average planting areas per farmer, reached 1.2 million smallholder farm households.



One of the mungbean workshops held in Myanmar

The study is now being expanded to collect similar data for six more countries in Southeast Asia, China, and three countries in East Africa to obtain a comprehensive global overview of the adoption of improved mungbean technologies. The studies in South Asia were financially supported by the UK Government's Department for International Development (DFID) and the Federal Ministry of Economic Cooperation and Development (Germany).

Top five imported mungbean varieties per country, in % of area planted for surveyed locations 2016-2017

Bangladesh		India		Myanmar		Pakistan	
Variety name	%	Variety name	%	Variety name	%	Variety name	%
BARI Mung-6 *	48	IPM 02-3 *	16	Yezin 11 *	39	AZRI-06 *	59
BARI Mung-5 *	10	SML 668 *	9	Yezin 14 *	26	NM 11 *	29
BARI Mung-2 *	7	GM 4	6	Yezin 1	9	Inqilab Mung *	3
Binamoog-5 *	2	NUL 7	5	Yezin 9 *	7	Sona Mung *	<1
Binamoog-8	2	LGG 460	4	MAS 1 *	5	AEM 96	<1

* Variety with WorldVeg-developed genetic material in its pedigree. Source: Schreinemachers *et al.* (2019)



Burchid Resistant Mungbeans developed by the World Vegetable Center

Contributed by Abdul Rasheed War

India is the leading producer of mungbean with 65% of the world acreage and 54% of the global mungbean production. It is an excellent source of digestible proteins, carbohydrate, vitamins, and minerals and forms an important part of the daily diets as dal (a stew made of dried pulses) and in sweets, snacks, and savory foods across the Indian subcontinent. Its demand as sprouts and noodles is high in China, Iran, Indonesia and Thailand. Based on colour and texture, mungbean seeds can be classified into dull green, shiny green or yellow seeded. When used as whole grains, consumers' preference grain size, seed coat luster (shiny or dull), and seed coat color (green or yellow). Shiny green seeds are in great demand in the Indian subcontinent but some countries like Indonesia, Taiwan, Kenya and Tanzania prefer dull green seeded mungbeans.

Azuki bean weevil (*Callosobruchus chinensis* L.) and cowpea weevil (*Callosobruchus maculatus* Fab.) are the most serious species of bruchids infesting mungbean. Although bruchids initiate seed damage in the field, they are serious pests in storage and can cause losses up to 100% if not managed. The larva (grub) burrows through the seed coat into the seed endosperm directly from the egg and feed inside the endosperm of the seed. The adult emerges by chewing and removing a circular piece of the seed coat to form a characteristic round exit hole. Bruchids reduce the nutritional and market value of the grain and render seeds unfit for human consumption, agricultural and commercial uses. Bruchids in storage are managed through fumigation with highly toxic chemicals such as carbon disulfide, phosphene and methyl bromide; or by dusting with several other insecticides which leave residues on the grain. Both of these methods of pest management can compromise food safety.

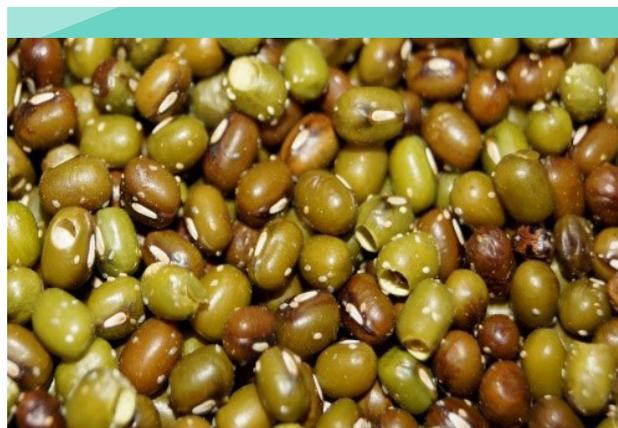


Although few dull green seeded bruchid resistant mungbeans are available, the shiny green seeded mungbean is susceptible to this pest. WorldVeg has developed mungbean lines that are resistant to cowpea weevil. The experiments for screening mungbean against cowpea weevil were carried out during 2017-2019 under laboratory conditions using the cup technique. Fifty seeds of each line were placed in the individual cup and five pairs of newly emerged adults were released. The experiment was set out in a complete randomized design and replicated three times.

Oviposition, adult emergence, larval longevity, seed damage and susceptibility index were recorded. Adult emergence was recorded starting from the 28th day of the infestation. It was found that the shiny green seeded mungbeans (AVMU1601, AVMU1605 and AVMU1606) are resistant. Further, the dull seeded mungbean lines resistant to bruchids included AVMU1603, AVMU1604, AVMU1609, AVMU1612, AVMU1613, AVMU1618, AVMU 1620, AVMU 1621, AVMU1622, AVMU1623, AVMU1624, AVMU 1625, AVMU1626, AVMU1627, AVMU1628, AVMU1629 and AVMU1630. These improved mungbean lines resistant to bruchids could revolutionise the mungbean industry and help farmers to store mungbean without applying the harmful fumigants and concern of bruchids consuming their produce.



AVMU 1601 (Shiny-Resistant)



NM94 (Susceptible check)

Reaction of green shiny mungbean lines against bruchids



Let's Expand the Network!

Contributed by Delphine Larrousse

On April 23rd-24th, 2019, the World Vegetable Center (WorldVeg) in partnership with the Kasetsart University, Thailand, organized a regional workshop entitled “Enhancing farmers’ access to improved mungbean varieties and good agricultural practices in Southeast Asia”. The event brought together mungbean researchers from the public and the private sector from Cambodia, China, Indonesia, Laos, Philippines, Thailand, Vietnam, as well as WorldVeg experts to exchange information and share knowledge about mungbean production and consumption in the region.

WorldVeg presented early results of a study conducted in Southeast Asia showing the large diversity of mungbean production systems and constraints faced by each country. Interestingly, while the topmost constraints in Cambodia relate to the lack of suitable varieties and low-quality seed, the top constraints in Laos relate to low prices and unstable markets, whereas in Vietnam pest and disease are the most important issues. During the workshop, participants presented the status of mungbean production and the different uses and consumption habits (sprouts, bean, added-value products) in their respective countries, and discussed research priorities. The group identified several common areas of interest along the entire mungbean value chain from breeding, seed production and mechanization, to postharvest technologies, processing and the promotion of mungbean consumption. The potential of this highly nutritious, affordable and sustainable crop to improve farmers’ incomes and family nutrition in the region is enormous.



Mungbean experimental lines shown to workshop participants at the World Vegetable Center Research Station in Kamphaeng Saen, Thailand.



Participants of the regional workshop “Enhancing farmers’ access to improved mungbean varieties and good agricultural practices in Southeast Asia” held on April 23-24, 2019 at the World Vegetable Center, East and Southeast Asia Regional Office, Thailand.

The workshop informed participants about the current status of the WorldVeg mungbean improvement program and demonstrated a selection of mungbean lines from World Vegetable Center and Kasetsart University, which should enable mungbean breeders in the region to identify germplasm for use in their improvement programs. Although overall demand for mungbean is rising in the region, only very few mungbean experts are present in each country. Participants saw significant benefits (e.g. mutual learning, international networking, development of collaborative research projects, exchange of germplasm and varieties) of international collaboration, and agreed to meet on a yearly basis and mobilize financial resources to support common projects. Hence, the obvious question is: Shall we expand the existing International Mungbean Improvement Network (IMIN)?

Given the great success of the workshop and high interest of participants, WorldVeg will explore this opportunity with current and future members as well as potential funding partners. IMIN – funded by ACIAR – includes Australia, Bangladesh, Myanmar and India. Organizations from seven other countries could be added as a result of this workshop, which would significantly increase the scope and potential impact of the network, and ultimately benefit farmers and consumers in 11 or more countries.

In addition to improving nutrition and livelihoods, this initiative aims to enhance international partnerships and improve regional coordination, one of the United Nations Sustainable Development Goals (#SDG17).

WorldVeg is proud to contribute to this large-scale collaborative effort and act as a connector between so many brilliant men and women scientists! Stay tuned on the evolution of the network!





News from India

Contributed by Aditya Pratap

The Mungbean Stakeholders Workshop was held at the ICAR-Indian Institute of Pulses Research, Kanpur from 10th - 11th February 2019. Fifty stakeholders attended the workshop included progressive mungbean farmers, representatives from Dal Millers Association, leading industrialists dealing with pulse products, equipment manufacturers and renowned mungbean researchers from India. Notably in attendance was Dr. Masood Ali, Dr. D.P. Singh, Dr. N.P. Singh, Dr. Sanjeev Gupta, Dr. T.S. Bains and Dr. Prasoon Verma.

The first day of the workshop addressed the 'Status of mungbean research and development in India', 'Millers' perspective on mungbean research and development' and 'Identifying grey areas in breaking yield barriers and restructuring plant types in mungbean' which stimulated interactive discussion over the day. Day 2 of the workshop fostered discussion on 'Farmers' perspective on yield maximization and economic gain' and 'Storage and post-harvest management' and 'defining product pipeline: estimation of the timeline and optimization of deliverables'.

Discussions from this workshop concluded that that mungbean varieties with the thin seed coat and bright yellow cotyledon are most preferred by the consumers, dal millers and snack manufacturers. Summer-grown crop also is more preferred compared to Kharif or Rabi crop because of its uniform seed size, high grain quality and reduced moisture content. The major recommendations of the workshop included an increased focus on breeding for medium grain size (3.4-4.2 g/100 seed), pre-harvest sprouting tolerance and bruchid resistance, restructuring plant types for mechanical harvesting, increased involvement of the private sector in R&D and promoting custom hiring for farm mechanization. It was unanimous amongst the group that mungbean in India is known for its olfactory properties and breeding specialty mungbean varieties with these qualities are required. The workshop ended with a pledge to promote mungbean to improve the socio-economic conditions of the farmers.



Participants of the Mungbean Stakeholders Workshop 10th-11th February 2019

News from Bangladesh

Contributed by AKM Mahbubul Alam and Md Abdul Muktadir

In Bangladesh, the suitability of mungbean to fit into the rice-based cropping pattern, with a potential yield of 1.5 -1.8 t/ha compared to the national average of 1.11 t/ha is leading to a rise in popularity for farmers in Bangladesh. However, due to climate change, mungbean cultivation is impacted by strong abiotic and biotic stresses including water-logging, salinity, heat- stress and mungbean yellow mosaic disease (MYMD). Pulses Research Centre (PRC) of the Bangladesh Agricultural Research Institute (BARI) launched an intensive mungbean improvement program in 1979 to produce enhanced mungbean varieties. PRC, BARI also received a total of 300 accessions/lines from WorldVeg under the International Mungbean Improvement Network (IMIN). Screening of the introduced material is in progress at different geographical locations.



Dr. A. K. M. Mahbubul Alam (left) explaining Incorporating Salt-Tolerant Wheat and Pulses into Smallholder Farming Systems in Bangladesh to Dr. William Erskine, University of Western Australia (right) during field visit at Barishal

Alongside this, PRC is also implementing an ACIAR funded project 'Incorporating Salt-Tolerant Wheat and Pulses into Smallholder Farming Systems in Bangladesh'. This project has prioritized development of waterlogging and salt tolerant mungbean, cowpea and grasspea varieties for southern regions of Bangladesh. To date, PRC has released eight improved mungbean varieties, of which BARI mung 6 is the most widely cultivated throughout the country. The mungbean improvement research activities of PRC, BARI, include working with local and exotic germplasm collection, hybridization and generation advancement. Both inter and intraspecific hybridization programs are designed to develop high yielding, disease resistant (MYMD and Cercospora leaf spot), waterlogging tolerant and synchronous maturing genotypes. The program is also developing PCR based detection techniques for MYMD and genetic mapping of QTL for seed weight of mungbean. Currently, we are also working to develop high yield and disease resistant scented mungbean known as '*sonamung*'.

News from Myanmar

Contributed by Ram Nair

As part of ACIAR-IMIN project, a workshop was held in Yangon, Myanmar on 7-8 February, 2019, organized by Department of Agricultural Research (DAR), Myanmar. Participants in the workshop included representatives from DAR, Yezin Agricultural University (YAU), Myanmar Pulses, Beans & Sesame Merchants Association, Myanmar Awba Group, ICCO and farmers from Yangon region.

The workshop deliberated on market strategies for mungbean in Myanmar. Due to restrictions from the Indian market, Myanmar is exploring new market opportunities in China, Japan, European Union and United Arab Emirates. In order to reach these markets, the 'Myanmar Mission Export Strategy' outlines that the increase of mungbean yield for export will focus on improved agricultural practices including good nutrient management. Currently, one of the major issues faced by the farmers in exporting mungbean is the use of banned chemicals and their residues on produce. The workshop also discussed the need for developing varieties that are suitable for the sprout market and also varieties that are suitable for mechanical harvesting. These varieties will be important in the regions with limited availability of labour at harvest time, leading to the reduced cost of production. Though mechanical harvesting has been started in some pockets of Myanmar, farmer trainings/awareness programs are needed to expand it. Overall, better dissemination of newly released varieties and adoption of Good Agricultural Practices by farmers are required to address these challenges.



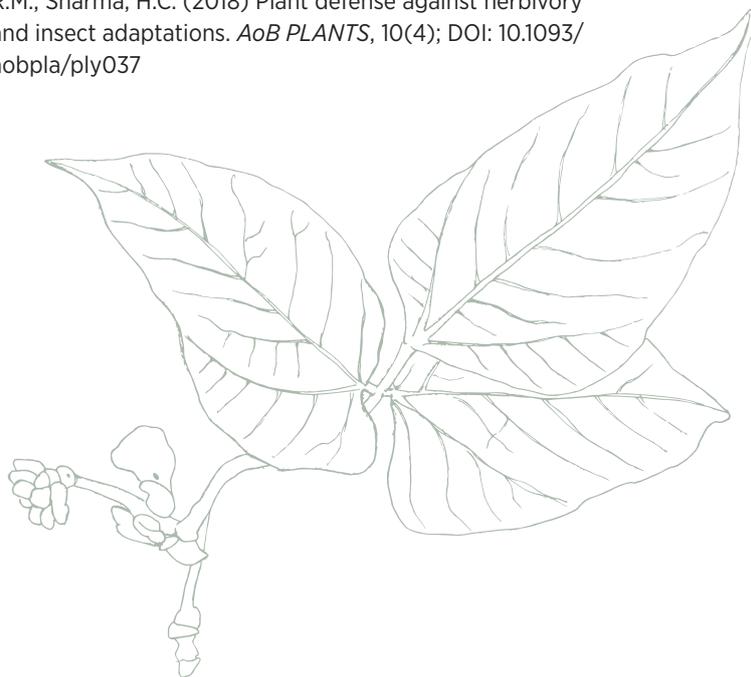
Mungbean Product Pipeline workshop in Myanmar attended by major stakeholders

Project news and events

KDDart training was conducted on 6-7 and 8-10 August 2018 in Bangladesh and Myanmar, respectively.

Research Publications

1. Pandey, A.K., Burlakoti, R.R., Kenyon, L. and Nair, R.M. (2018). Perspectives and challenges for sustainable management of fungal diseases of mungbean (*Vigna radiata* (L.) R. Wilczek var. *radiata*): A Review. *Frontiers in Environmental Science*. 19 June 2018 | <https://doi.org/10.3389/fenvs.2018.0005>
2. Priya, M., Sharma, L., Kaur, R., Bindumadhava, H., Nair, R.M., Siddique, K. H. M. and Nayyar, H. (2019). GABA (gamma-Aminobutyric acid), as a thermo-protectant, to improve the reproductive function of heat-stressed mungbean plants. *Scientific Reports*, 9: 7798-7801.
3. Priya, M., Sharma, L., Singh, I., Bains, T. S., Siddique, K. H. M., Bindumadhava, H., Nair, R.M. and Nayyar, H. (2019). Securing reproductive function in mungbean grown under high temperature environment with exogenous application of proline. *Plant Physiology and Biochemistry*, 140: 136-150.
4. War A.R., Taggar, G.K., Hussain, B., Taggar, M.S., Nair, R.M., Sharma, H.C. (2018) Plant defense against herbivory and insect adaptations. *AoB PLANTS*, 10(4); DOI: 10.1093/aobpla/ply037



Future Newsletters

The IMIN aims to publish a semi-regular newsletter and is now calling for submissions for the next edition. Please email tamaya.peressini@aciarc.gov.au to submit articles or for further information on the newsletter.

For further information on the IMIN:

Project Leader: Dr Ramakrishnan Nair
E: ramakrishnan.nair@worldveg.org
P: +91 40 30713756 F: +91 40 30713074



Follow Australian Mungbean work on Instagram at [mungbean_au](https://www.instagram.com/mungbean_au)



Mukimo 'Kenya' – Mungbean and potato mash

Contributed by Ms. Rael Karimi, Kenya Agricultural and Livestock Research Organization (KALRO), Kenya

Mungbean (Green gram) recipes are popularly known as 'Mukimo' in Kenya. This food product is prepared by mashing cooked whole grain of mungbean with boiled Irish potatoes, sweet potatoes, green bananas or pumpkins. This product can be served with fried cowpea, vegetables, spinach, kales or beef stew.

Ingredients:

- 1 cup mungbean grain
- 1kg of Irish potatoes
- 5 medium-sized green bananas
- Sweet potatoes
- Salt to taste

Method:

1. Cook the selected clean mungbean grain to desired tenderness and set aside
2. Carefully peel the potatoes, wash them clean and cook until soft
3. Add the cooked mungbean to the potatoes
4. Add salt to desired taste and cook the mixture for 10 more minutes
5. Ensure water is completely drained
6. Reduce the heat and mash together until uniformly blended
7. Serve with beef stew, chicken stew or fried green vegetables.



Staff feature from Bangladesh

Introducing Mr. Rais Uddin Choudhury

Mr. Rais Uddin Choudhury was appointed as Director of Pulses Research Centre, BARI, Ishwardi, Pabna, Bangladesh in March 2019. Before joining the Pulses Research Centre, he was Chief Scientific Officer at Regional Agricultural Research Station, Rangpur. During his career, Rais has been engaged in various research roles. He has extensive experience in conducting field-based research addressing regional problems. Rais has developed many technologies for different crops involving mixed cropping, intercropping and rice based cropping systems. He has made a significant contribution to improved fertilizer management strategies and farming methods under rainfed condition in several crops. Rais has also been involved in variety development programs, characterizing germplasm of lentil, mungbean, chickpea, brinjal, snake gourd, yam and medicinal plants.

Rais has a Bachelor's degree in Agricultural Science from Bangladesh Agricultural University, Mymensingh, Bangladesh. He has been at the Plant Genetic and Resource Centre, BARI since 2010 where he has been involved in collection, characterization and evaluation of germplasm of different crops including legumes

