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MUNG CENTRAL

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

Editorial

The second annual meeting of the network was held in Dhaka during 30-31 May 2017. Participants from the partner countries including representatives from the private sector discussed the progress made and formed plans for the network's future activities.

Mungbean mini-core collection – a treasure trove of resistance genes! The mungbean mini-core collection developed by the World Vegetable Center and shared with partners is proving to be a novel source of genes for resistance to major diseases affecting mungbean. Preliminary screening of the collection by partner countries have identified sources of resistances to diseases such as mungbean yellow mosaic disease, powdery mildew, tan spot, halo blight and dry root rot. Seed multiplication of the collection is being progressed by partner countries for further characterisation and testing for other traits.

In order to improve the collection and processing of data, the network is organising a training program on plant breeding, database management and statistics from the 23-27 October 2017 at the WorldVeg South Asia office in Hyderabad.

We hope you enjoy this third edition of Mung Central. To access previous editions visit: http://aciar.gov.au/search?terms=mung+central&items_per_page=25&=Search

Dr. Aung Thu, Honourable Union Minister of Agriculture, Livestock and Irrigation (MOALT), Myanmar at the Food and Legumes Section, DAR, Yezin - seed multiplication of the WorldVeg mungbean lines.

What we do

News from Myanmar: Boost to the IMIN activities in Myanmar

On 28 July, Dr. Aung Thu, Honourable Union Minister of Agriculture, Livestock and Irrigation (MOALT), Myanmar visited the Food and Legumes Section, Department of Agricultural Research (DAR), Yezin. Dr. Tun Shwe, Director, Food Legumes and Oilseeds, DAR, briefed the minister about the project activities and its potential benefit to Myanmar's mungbean production. Mr. Naing Kyi Win, Director General, DAR, Mr. Thant Lwin Oo, Deputy Director General, DAR, Dr. Myat Nwe Nwe, Head, Food Legumes Section, DAR and Dr. Ram Nair, Legume Breeder, WorldVeg, were also present. This was followed by a visit to the seed multiplication site of the recently introduced WorldVeg mungbean lines as part of the project.

Myanmar as a benchmark country for mungbean production

During July 2017, the Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) and the University of the Philippines Los Baños - Institute of Plant Breeding (UPLB-IPB) visited Myanmar to study best practices in Myanmar on mungbean production, post-harvest handling and processing, which could potentially be applied in the Philippines.

Philippines team (Dr. Rodel Maghirang and Mr. Rolando Corpuz, first and second from the right) along with Dr. Tun Shwe and his team and Dr. Ram Nair, Legume Breeder, WorldVeg, in mungbean field at the Thatkon Research Station, DAR.

Mr. Rolando Corpuz, ISP Manager – Legumes, DOST-PCAARRD, Los Baños, Laguna said, "our country imports nearly 50% of the domestic requirement of mungbean and our farmers' average yield is only 0.81 t/ha.

We believe that Myanmar and the Philippines have almost the same climate condition. But I guess an important factor for Myanmar high crop yield is the implementation of improved cultural and management practices coupled with the use of new varieties."

Dr. Rodel Maghirang, Vegetable Breeder, UPLB-Institute of Plant Breeding, Laguna stated that in the Philippines, San Mateo, Isabela province is known as the capital for mungbean production and they are interested in improving mungbean productivity with the use of improved mungbean lines from the IMIN project.

Participants at the second annual project meeting in Dhaka during 30-31 May 2017.

News from Bangladesh

Contributed by Col Douglas

Project participants at the 2017 IMIN annual meeting hosted by BARI in Gazipur inspected 400 mungbean lines being screened for mungbean yellow mosaic disease (MYMD). Under high virus pressure, Australian commercial varieties were highly susceptible, severe yellowing of leaves and pods was evident with low levels of grain production. MYMD is a significant constraint to mungbean productivity throughout South Asia; the virus is not present in Australia but is a potential threat to the industry. Australian breeders are eagerly anticipating unlocking the potential from the promising new WorldVeg breeding lines, which have demonstrated strong resistance to MYMD. Development and deployment of MYMD resistance varieties is a major objective of this project.

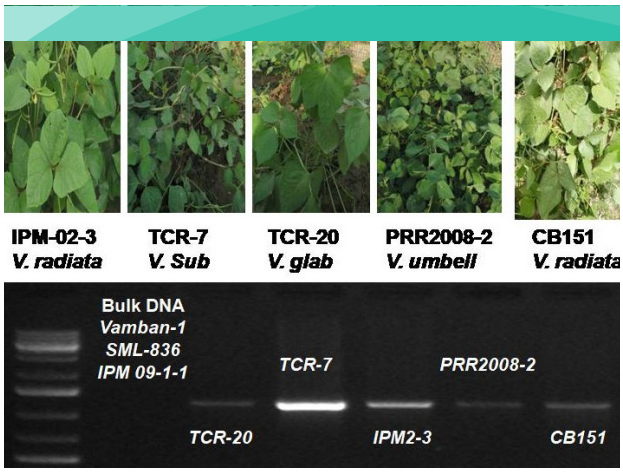
Severe incidence of MYMD on the mungbean fields in Gazipur, BARI, Bangladesh.

One of the WorldVeg lines on the right showing resistance to MYMD under severe disease pressure at Gazipur, BARI, Bangladesh.

News from India: Durable sources of resistance to yellow mosaic disease in Asiatic Vigna gene pool

Contributed from Aditya Pratap, Sanjeev Gupta and Chandra Mohan Singh, ICAR-Indian Institute of Pulses Research, Kanpur

Yellow mosaic disease (YMD), caused by Geminiviruses (genus Begomovirus, family Geminiviridae) is one of the most devastating diseases of mungbean in India, causing tremendous yield losses every year. To search for durable sources of resistance against this disease, 290 Asiatic Vigna accessions including 101 wild vignas belonging to 22 species and 189 germplasm lines (164 mungbean (*Vigna radiata*); 20 urdbean (*V. mungo*) and 5 rice bean (*V. umbellata*) accessions) were evaluated for YMD resistance in three different environments, including ICAR-IIPR Main Farm and ICAR-IIPR, New Research Campus, Kanpur and the Regional Centre, Dharwad (Karnataka) during 2016-17. Phenotypic data were recorded on a 0-9 scale on all these accessions at 3 locations and it was observed that 117 accessions, including cultivated species and breeding lines (58), and wild accessions (59) belonging to 19 different species, were stable for resistance to YMD over the locations. Genotyping was performed on the samples collected from Kanpur for identification of YMD-causing virus. DNA was extracted from the pooled leaf samples of the infected lines. The DNA samples were subjected to rolling circular amplification (RCA) to enrich the quantity of viral DNA followed by digestion with single cutter enzymes for both DNA-A and DNA-B, releasing the 2.7 kb fragment. The PCR with specific primers for MYMIV, MYMV and HgYMV was performed to confirm the presence of viruses. The samples were found to be positive for MYMIV only, while the presence of other YMD-causing viruses is still being confirmed.



Some representative resistant accessions characterized by CYR1 from GP1, GP2 and GP3 (V-1, SML-836 and IPM09-1-1 are highly susceptible, TCR-20, TCR-7, IPM2-3, PRR2008-2 and CB151 are highly resistant). (Photo credit: Aditya Garg)

Major Whitefly biotypes and strains of the virus causing MYMD identified in India

Contributed by Ram Nair, WorldVeg South Asia, Hyderabad

A major constraint for improved productivity in mungbean is the yield loss caused by mungbean yellow mosaic disease (MYMD). This disease is caused by several begomoviruses which are transmitted by the whitefly *Bemisia tabaci*. In a collaborative study with national partners, WorldVeg identified the major cryptic species of *B. tabaci* associated with this crop and the predominant begomoviruses infecting mungbean in India. The indigenous *B. tabaci* cryptic species Asia II 1 was found dominant in Northern India, whereas Asia II 8 was found predominantly in Southern India. Repeated samplings over consecutive years indicated a stable situation with Mungbean yellow mosaic virus (MYMV), strains genetically most similar to a strain from urdbean (MYMV-Urdbean) predominant in North India, the strains most similar to MYMV-Vigna predominant in South India, and Mungbean yellow mosaic India virus (MYMIV) strains predominant in Eastern India. In field studies, mungbean line NM 94 showed a high level of tolerance to the disease in the Eastern state of Odisha, where MYMIV was predominant and in the Southern state of Andhra Pradesh, where MYMV-Vigna was predominant, but only a moderate level of tolerance in the Southern state of Tamil Nadu. However, in Northern parts of India, where there was high inoculum pressure of MYMV-Urdbean during the Kharif season, NM 94 developed severe yellow mosaic symptoms. The identification of the high level of tolerance in mungbean lines such as ML 1628 and of resistance in black gram and rice bean provides hope for tackling the disease through resistance breeding.

For more details please refer to Nair et al., 2017, Eur J Plant Pathol https://link.springer.com/article/10.1007/s10658-017-1187-8

News from Australia

Contributed by Col Douglas

A new glasshouse facility at DAF's Hermitage Research Facility is the starting point in Australia's mungbean breeding program. The WorldVeg mini-core collection that has only been in Australia for 18 months is already making its way into the program. Twelve mini-core accessions which indicated promising foliar disease resistance in 2017 trials have been used in thirty new crosses, almost a quarter of the Australian cross-pollination program for 2017. The mini-core contribution will increase in subsequent years as more data is collected and analysed.

Mungbean mini-core collection in the greenhouse in Australia. (Photo credit: Dr. Col Douglas)

News from the World Vegetable Center, HQ, Taiwan: Broadening the genetic base of mungbean – Collection of wild Vigna accessions in Taiwan

Contributed by Roland Schafleitner, WorldVeg

All crops are derived from wild plants. During domestication, the farmers selected genotypes with good taste, high yield and good agronomic properties. During this selection, many traits such as disease resistances or tolerances to environmental stresses may have been left behind and are absent in the cultivated genotypes. Therefore, breeders must source these traits from wild relatives.

Mungbean is frequently grown in arid areas, where inappropriate irrigation may lead to accumulation of salt in upper soil layers. Mungbean is relatively susceptible to salt stress, consequently, yields on saline soils are low. Moderately salt tolerant accessions have been found in the mungbean mini core collection, but highly tolerant genotypes are not available.

Joyce Yen (WorldVeg – Biotechnology) harvesting *Vigna marina* seed in Penghu, an archipelago off the west coast of Taiwan. (Photo credit: Dr. Roland Schafleitner)

In contrast to mungbean, *Vigna marina* (beach cowpea), a distant relative of mungbean, can tolerate high levels of salinity. The seed of this species can survive up to 25 years floating in salt water (https://search.informit.com.au/documentSummary;dn=174719815713738;res=IELHSS). It grows on sandy and stony beaches just above the high tide mark throughout the tropics. The WorldVeg germplasm collection contains only two *V. marina* accessions, too little to learn about salt stress tolerance of this species and explore possibilities to introduce this trait into cultivated mungbean. According to Takahashi et al. (2016), *V. marina* is only distantly related to mungbean (*Vigna radiata*) and crossing of these two species might not be possible. However, learning about the salt tolerance traits in beach mungbean might guide selection efforts to breed salinity tolerant mungbean.

To augment the genetic resources for salt tolerance research in the genus Vigna, a collection mission for *V. marina* has been initiated by WorldVeg with funding from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through the German Federal Ministry for Economic Cooperation and Development. Beaches in Taiwan and of the outlying islands are currently examined for the presence of *V. marina*. Seeds are collected, the habitats are characterized and the geographical coordinates of the collection sites are registered. Up to now, 26 new accessions have been collected and transferred to the WorldVeg Genebank for multiplication. The collection sites of *V. marina* look like holiday spots, but spotting the plants and harvesting seed is hard in the Taiwanese summer heat. In parallel, root nodules of *V. marina* are collected whenever possible to characterize the nitrogen-fixing rhizobia strains associated with this species in salt stress environments. It is likely that not only the plant but also the bacterial symbionts adapt to salt stress environments. The extent to which these bacteria can improve nitrogen fixation under salt stress tolerance is set to be explored.

Two popular mungbean recipes from Bangladesh

Contributed by AKM Mahbubul Alam

Mungbean with mixed vegetable curry

Ingredients:

1. Split green mungbean (mung dal): 1.5 cups
2. Vegetable mix (country bean, Amaranth, Cauliflower): 3 cups
3. Ginger paste: 1 teaspoon
4. Tumeric powder: 1/2 teaspoon
5. Green chilies: 4-5 pieces
6. Onion (finely chopped): 1 teaspoon
7. Garlic (finely chopped): 1/2 teaspoon
8. Coriander: 1 teaspoon
9. Cumin (paste): 1 teaspoon
10. Ground cumin: 1/2 teaspoon
11. Salt to taste

Preparation

Rinse mungbeans and chop or dice all vegetables. Boil the mungbeans (dal) with 4-5 cups of water in a saucepan until the dal is tender. Combine dal with vegetable mix, turmeric, salt and cumin (paste) and cook until the dal becomes split. Heat oil in another large saucepan over medium heat and add the ground cumin, stirring for a minute or two. Add remaining spices, stir for about 15 seconds, and then add onion, ginger and green chillies to the pan. Fry until the onion wilts and begins to brown. Now add the mung dal and chopped coriander leaf, partially cover the saucepan and immediately reduce the heat to simmer for another 4 to 5 minutes, until flavour comes out. Serve hot.

Mung dal mutton curry

Ingredients:

1. Split green mungbean (mung dal): 2 cups
2. Boiled mutton: 500g
3. Ginger paste: 2 teaspoons
4. Onion paste: 2 teaspoons
5. Garlic paste: 1.5 teaspoons
6. Onion (finely chopped): 2 teaspoons
7. Cumin powder: 1 teaspoon
8. Bay leaves: 2
9. Spices powder: 1/2 teaspoon
10. Corriander powder: 1/2 teaspoon
11. Tumeric powder: 1 teaspoon
12. Hot chili powder: 2 teaspoons
13. Salt to taste
14. Vegetable oil to cook

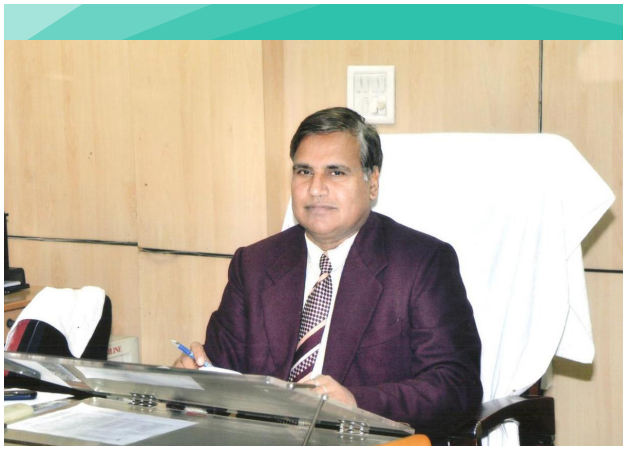
Preparation

Clean mung dal and pick out stones if any. Rinse the mung dal, place in a bowl covered with water for 2-3 hours to soak. Heat the oil in a large saucepan over medium heat, add onion and fry until the onion wilts and begins to brown. Now add ginger paste, onion paste, garlic paste, turmeric powder and hot chili powder. After frying for 25-30 seconds add mutton, mung dal and salt, heat for 10 minutes. Add 6-8 cups of hot water, cover the saucepan, and cook for about 30 min to 1 hour or until mungbeans are tender. Drain the excess water, add remaining spices and reduce the heat to simmer for another 4 to 5 minutes, until flavour comes out. Serve hot with rice or bread.

Future Newsletters

The IMIN aims to publish a semi-regular newsletter and is now calling for submissions for the next edition. Please email emily.lamberton@aciar.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



Staff feature from India

Dr. Narendra Pratap Singh

Dr. Narendra Pratap Singh is an eminent pulse geneticist and breeder and is currently working as the Director of the ICAR-Indian Institute of Pulses Research, Kanpur. Previously, he coordinated and guided India's national chickpea research program as the National Project Coordinator. Dr. Singh has been instrumental in the development of >50 promising varieties of pulses including chickpea, mungbean, urdbean, lentil and fieldpea, in addition to publishing over 180 research papers in journals of repute and several books, bulletins and book chapters. Under his stewardship, the earliest duration mungbean variety, IPM 205-7 (Virat), has been developed recently for cultivation across India, which matures in <55 days. He has also been the leader in the development of first pod borer resistant chickpea and pigeonpea through transgenic approaches that have now entered the confined field trial stage and will be released for commercial cultivation. He has been instrumental in developing the policy documents on creating self-sufficiency in pulses in India.

Dr. Singh is an active participant in the 'International Mungbean Improvement Network' project.

Project News & Events

The inception meeting of another project funded by ACIAR on "Improved Mungbean Harvesting and Seed Production Systems for Bangladesh, Myanmar and Pakistan" will be held in Myanmar during 11-12 October 2017. This project is expected to trigger active participation of the private sector in the network activities, particularly in the seed sector.

The network has initiated the implementation of KDDart, a breeding management system developed by Diversity Arrays Pty Ltd, Canberra. A training program on the above system will be held during 23-27 October 2017 at the WorldVeg South Asia office, Hyderabad, India.

The International Tropical Agriculture Conference (TropAg) will be held in Brisbane, Australia from the 20-22 November 2017, a symposium on tropical pulses will be held alongside. Go to the conference website (http://tropagconference.org) to register.

Since its inception, the IMIN holds fortnightly zoom meetings to update project progress and outputs. This continues to help all partners stay updated across borders.

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