



Australian Government

Australian Centre for  
International Agricultural Research

# MUNG CENTRAL

The IMIN is a collaboration between The World Vegetable Center 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

There has been great success for the IMIN since the last edition of MungCentral. While the world is in a grave situation due to the Covid-19 pandemic, the IMIN team has delivered positive impacts to breeders, farmers, sellers and customers of mungbean products.

The network is in the process of securing funding for phase 2 to continue the concerted efforts in mungbean research for the next five years. So more good things to come!

Please read on to celebrate the achievements of the network over the past 8 months, the world can always do with a little more mungbean in it!

If you are interested in finding out more about collaboration with the IMIN, please email: [ramakrishnan.nair@worldveg.org](mailto:ramakrishnan.nair@worldveg.org).

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

## Mungbean going for gold in Australia

Contributed by Col Douglas

DAF's Hermitage Research Facility won the Australian Summer Grains Conference Mungbean Award.

This award recognises mungbean industry leadership in the sixteen years since DAF initiated the National Mungbean Improvement Program. Industry impacts include:

- four-fold growth in production since 2003
- a record crop of 150,000 tonnes in 2016 worth \$180M delivering a return of 12:1 on the Queensland Government's investment
- game-changing improvements in yield and reliability through five successive variety releases

- transformation of the mungbean research landscape
- establishment of the summer grains industry's premium annual field day

This award also recognises the support of the sorghum pre-breeding and sorghum physiology (DAF and QAAFI) teams, and the barley pathology teams at Hermitage, who have enthusiastically shared their ideas, skills and experience to transform mungbean research and future delivery to Queensland's export markets.

The Australian Mungbean Association (AMA) said it is grateful for the dedication and professionalism of past and present staff of DAF's Hermitage Research Facility that have supported the growth of the Australian mungbean industry.

DAF's Hermitage Research Facility has been contributing to grains research for 122 years, and is the home of Queensland's tropical pulse industry.



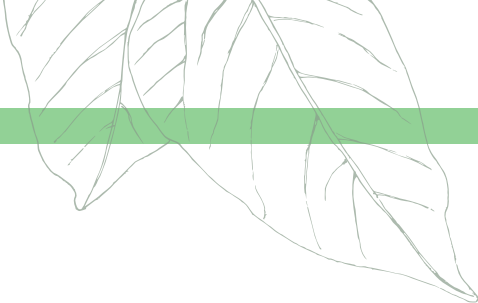
Hermitage Research Facility staff with the Australian Summer Grains Conference Mungbean Industry Awards. L-R Brett McIntyre and Mark Schmidt (AMA) with Hermitage's Col Douglas (Senior Mungbean Breeder, DAF) and Professor Andy Borrell (QAAFI)

## Inclusive crop improvement

Contributed by Lutz Depenbusch and Ramakrishnan Nair

When deciding what a new mungbean variety should look like, who would you ask for advice? The obvious first step is to the ask the farmers growing the crop. Then one might even ask processors, exporters, and retailers.

But is this enough? Do all the farmers, and processors demand the same thing?



Asking these questions may lead you to think that this is not enough and that you need more in-depth knowledge before settling for the long-term goals written down in the product-profile of the breeder.

With this thought in mind, WorldVeg mungbean breeder Ramakrishnan Nair and economist Lutz Depenbusch set out to learn new approaches to defining a product-profile. Together with 14 teams from all over Africa, they met in Kampala, Uganda, to join a course on gender responsive plant breeding. The course was organized by Makerere and Cornell Universities as part of their GREAT program. Over three weeks, a team of experienced social and natural scientists showed the teams how to identify what women and men expect from new varieties and how to apply this knowledge in their breeding programs.

With two weeks of training behind them and one week ahead, the WorldVeg scientists went to Myanmar in November. With the support of Yezin Agricultural University and the Department of Agricultural Research they engaged with two groups of women who are employed in mungbean harvesting. Every year these women spend one-and-a-half months migrating from Nay-Pyi-Taw region to the large mungbean fields in Bago region.

With the new won insights in their luggage, Drs. Nair and Depenbusch were able to graduate from the second round of the GREAT course in January 2020. These new insights will be vital for the the ACIAR funded project "Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan". Learning from the workers in Myanmar already inspired the next steps to find a system that helps mungbean farmers complete their harvest on time, while protecting the livelihood of those who depend on incomes from the harvesting.

## DAF scientist awarded for being a mungbean champion

Contributed by Col Douglas

Agri-Science Queensland's (ASQ) Dr Rex Williams has been made a Lifetime Member of the Australian Mungbean Association (AMA) in recognition of his outstanding contribution to the mungbean industry.

Dr Williams completed a PhD on mungbeans at the University of Queensland in 1989 titled, A study of the causes of, and selection for resistance to, weather damage in mungbean, under the guidance of AMA Lifetime Members Professor Bob Lawn and Dr Bruce Imrie. He also contributed to the development of Australia's first dull-seeded mungbean variety 'Satin'.

After nearly 23 years as a lucerne breeder in New South Wales, Dr Williams joined DAF in 2006 and soon reinstated his links with mungbeans as Director of the Queensland Government's Crop Improvement unit.



Left to right: AMA President Mark Schmidt, Dr Rex Williams, and AMA Treasurer Brett McIntyre.

AMA president Mark Schmidt said the mungbean industry was indebted to Dr Williams for his enthusiastic support over many years.

"The growth of the mungbean industry to its current five-year average value of over \$120 million in export earnings is underpinned by focused agronomic research and the development of ever-improving mungbean varieties," said Mr Schmidt.

"Dr Williams has been a key player in achieving this outcome and we are pleased to recognise his contribution to the industry with this special award."

DAF Principal Mungbean Breeder, Col Douglas, said Rex's outstanding research achievements and industry impact includes delivering more than \$10 of benefits to industry for every \$1 of public funds invested in Queensland's pulse research and breeding.

"Rex has contributed to the rise of Queensland's tropical pulse industry, with record crops of both mungbean and chickpea worth half a billion dollars in 2016, the United Nation's International Year of Pulses."

"Through his strong advocacy for DAF's involvement in the International Mungbean Improvement Network Rex has increased capacity and investment for mungbeans beyond what would otherwise be achievable for public sector breeding of a niche crop in Australia" Mr Douglas said.

"He has also supported the release of five (and soon to be six) mungbean varieties, including Crystal and Jade-AU, and five desi chickpea varieties including PBA HatTrick, PBA Seamer and PBA Drummond; a pulse partnership with Queensland University of Technology (QUT) to develop new knowledge and traits for chickpea and mungbean; and the development and extension of mungbean best management practice in Queensland."



## Annual Meeting of International Mungbean Network

Contributed by Aditya Pratap

The annual meeting of the ACIAR-funded International Mungbean Improvement Network was organized at ICAR-Indian Institute of Pulses Research, Kanpur on September 8-10, 2019.

More than 20 project partners from different organizations participated including World Vegetable Center; Bangladesh Agricultural Research Institute; Department of Agricultural Research Myanmar; and Agri-Science Queensland, Australia; besides ICAR-IIPR. Dr. N.P. Singh, Director, ICAR-IIPR; Dr. Masood Ali, the former Director of the Institute and Eric Huttner, Research Program Manager, Crops, ACIAR were in attendance.

All project partners presented the progress achieved over the last year and deliberated upon the technical programme for the coming year. Discussions were held on field performance of the mungbean mini-core collection and advanced breeding lines, data management using KDDart, yellow mosaic and new emerging viral diseases in mungbean, molecular breeding and marker assisted selection, new sources of resistance to biotic and abiotic stresses, each institute's product pipeline and linkages with ACIAR and other national and International projects.

Discussions were also held on the extension phase of the project till June 2020 and additional activities were underpinned for this phase. A tentative work plan as well as inclusion of new partners in phase 2 of the project were considered. The meeting ended with a pledge to foster mungbean research and development to enhance its global impact in nutritional and socio-economic security of the masses.



Project partners at the IMIN Annual planning meeting

## Winning a grant for the greater good

Contributed by Roland Schafleitner

At the Plant and Animal Genome Conference in San Diego, California, on Jan 14, 2020, USA Illumina awarded Dr. Roland Schafleitner and the International Mungbean Improvement Network (IMIN) the 12th annual Illumina Agricultural Greater Good Initiative Grant for generating genomic resources for mungbean breeding, which contributes to food and nutrition security.

The grant makes it possible to test new mapping approaches as an alternative to genome-wide association studies (GWAS) to reveal the genetic basis of important traits. Additionally, the IMIN will build capacity to maximize the use of genetic sequencing information in its breeding programs; specifically to use biodiverse germplasm for breeding and tracking important genetic traits.

"This grant will give us access to a huge amount of sequence information and is a unique opportunity for the International Mungbean Improvement Network," said Schafleitner, World Vegetable Center.

"We can now dive into the genetic architecture of mungbean and get a much better understanding of the genetics of the species."

The IMIN, funded by the Australian Center for International Agricultural Research and coordinated by the World Vegetable Center, seeks to unlock the potential of mungbean to improve agricultural system productivity and livelihoods.

Mungbean is cultivated on around 6 million hectares, predominantly in Asia. Farmers appreciate the short duration and stress tolerance of the crop, but low yields and susceptibility to diseases are still a challenge for mungbean cultivation. Access to genomic sequencing information and genomic tools will accelerate breeding of modern improved mungbean varieties with farmer-preferred traits.

## New Mungbean Variety Developed in India

Contributed by Aditya Pratap

ICAR-Indian Institute of Pulses Research, Kanpur has recently developed a high yielding and multiple disease resistant variety of mungbean, IPM 512-1 alias "Soorya". Soorya is recommended for cultivation during the Spring season in North East Plain Zone (NEPZ) Soorya offers enormous potential for vertical and horizontal expansion of mungbean cultivation, as the NEPZ has an area of >150 thousand hectares of mungbean cultivation during Spring.

The breeding, selection and appraisal work of this variety was executed at the ICAR-IIPR, Kanpur from 2005-17. Overall, IPM 512-1/Soorya has the following characteristics

- average yield potential of 1.25 t/ha. across 20 locations
- showing a maximum yield of >2.0 t/ha at some locations
- demonstrated a yield advantage of >15% over the best check variety 'Pusa Vishal'
- highly resistant to Mungbean Yellow Mosaic disease and anthracnose
- moderately resistant to Cercospora leaf spot.
- less pod damage due to thrips observed
- synchronous maturity and has green, shining, attractive and medium large seeds (3.9g/100 seed).

Owing to these qualities, this variety will offer a better option to farmers for cultivation in during Spring season and provide a superior alternative to IPM 99-125 (Meha) after a gap of >15 years.



IPM512-1 (Soorya): Field view and grains



## More spring varieties identified for the Uttar Pradesh region

Contributed by Aditya Pratap

Two new varieties of mungbean viz., Vasudha (IPM 312-20) and Heera (IPM 409-4) have been recently identified for release in Uttar Pradesh. Vasudha (IPM 312-20), has been developed from the segregating materials of an inter-specific cross between *V. radiata* and *V. mungo*. This variety portrayed:

- a yield advantage of >18% over the best check variety IPM 99-125.
- resistance to yellow mosaic disease, powdery mildew and cercospora leaf spot.
- reaches maturity in 65-82 days with an average maturity period of 72 days across different locations in Uttar Pradesh.
- green, shining, attractive and medium large seeds (3.9 g/100 seeds) with high protein content (21.94 %)

IPM 409-4 (Heera) has been developed from the segregating materials of an inter-varietal cross between 'PDM2881' and 'IPM 3-1'. This variety exhibited:

- yield potential of >1.2t/ha portrayed a yield advantage of 13.41% over the best check variety IPM 99-125.
- resistant to yellow mosaic disease, powdery mildew and cercospora leaf spot.
- reaches maturity in 70-75 days.
- seeds are green, shining and medium large (3.9 g/100 seeds) with high protein content (25.78 %).

Both these varieties will offer suitable choice to farmers of Uttar Pradesh for cultivation during Spring season.



IPM 312-20 (Vasudha) and IPM 409-4 (Heera) in the field.

## Staff feature from Australia

### New to the network! Introducing Dr. Araz Solman



Araz Solman has joined the International Mungbean Improvement Network. He has been appointed by the Department of Agriculture and Fisheries and is based at the Hermitage Research Facility in Southern Queensland. Araz is Australia's first dedicated mungbean pathologist and will be working with the pulse breeding team with a focus on the bacterial diseases of mungbean. Araz will be working to refine screening protocols and then undertake phenotyping with germplasm panels, the Nested Association Mapping Populations and IMIN's interspecific breeding lines. Araz' work will contribute directly to IMIN's commitment to developing and deploying new varieties with bacterial disease resistance.

Araz has completed his PhD research in the Centre for Crop and Disease Management at Curtin University Curtin University in Perth. His PhD primarily focused on investigating disease development and pathogen interactions in wheat plants co-infected by two major fungi. Prior to his PhD, Araz worked as a research scientist at the International Centre of Agricultural Research in Dry Areas (ICARDA) employing farmer oriented plant breeding and management tactics to improve drought tolerance in wheat and barley crops for smallholder grain farmers in Syria and Iraq. Araz has led and published several papers in highly regarded international journals.



## 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@aciar.gov.au](mailto:tamaya.peressini@aciar.gov.au) to submit articles or for further information on the newsletter.

## For further information on the IMIN:

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

## Recipe corner



### Mung Dal Halwa - Contributed by Dr. Rakhi Gupta

Serves 4-5 people

#### Ingredients:

200g of Mung Dal (split and dehusked)

200g of Sugar

2 cups of Cow's milk

6-8 almonds, sliced

4-5 green cardamom (Ilaichi)

0.5gm of saffron

100gm of ghee

20gm of coconut powder

5-7 cashew nuts

#### Method:

1. Soak mung dal and almonds in water overnight.
2. Drain water and grind mung dal to a coarse paste.
3. Make sugar syrup of one string consistency in a pan with sugar and water on medium flame.
4. Dissolve saffron in some milk and keep aside. Remove the skin of soaked almonds and cut to small slices.
5. Heat clarified butter (ghee) in a fry pan and cook the mung dal paste till it becomes golden brown in low flame stirring continuously.
6. Add sugar syrup and milk. Cook it to thick consistency, stirring continuously on low flame.
7. Add sliced almonds and saffron milk. Cook till the milk dries up totally.
8. Halwa is considered to be ready when the mixture stops sticking to the pan.

## Research Publications

Nair, R. M., Schafleitner, R., and Lee, S-H (Eds.) The Mungbean Genome, Compendium of Plant Genomes P 191. 10.1007/978-3-030-20008-4 Springer Nature Switzerland AG

Nair, R.M., HanumanthaRao, B., Vemula, A. Abhishek, R., Tzvetina, B. and Rumen I. (2020) Availability of soil iron determines the distribution strategy and seed iron content in mungbean (*Vigna radiata*) plants. *Plant Soil* 446, 413–423 <https://doi.org/10.1007/s11104-019-04360-y>

Nair, R.M., Pandey, A.K., War, A.R., Hanumantharao, B., Shwe, T., Alam, A.K.M.M., Pratap, A., Malik, S.R., Karimi, R., Mbeyagala, E.K., Douglas, C.A., Rane, J., and Schafleitner, R. (2019) Biotic and Abiotic Constraints in Mungbean Production—Progress in Genetic Improvement. *Frontiers in Plant Science* 10:1340. doi: 10.3389/fpls.2019.01340

Pandey, A.K., Burlakoti R.R., Rathore, A., and Nair R.M. (2020): Morphological and molecular characterization of *Macrophomina phaseolina* isolated from three legume crops and evaluation of mungbean genotypes for resistance to dry root rot. *Crop Protection* 127: 104962

van Zonneveld M, Rakha M, Tan SY, Chou YY, Chang CH, Yen JY, Schafleitner R, Nair R, Naito K, Solberg SØ. 2020. Mapping patterns of abiotic and biotic stress resilience uncovers conservation gaps and breeding potential of *Vigna* wild relatives. *Scientific Reports*. 10:2111.

## Events

Mid-term Review of Project -CIM/2016/174 – Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan, 5-6 December, 2019 at Bangkok, Thailand.

International conference on “Pulses as the Climate Smart crops: Challenges and Opportunities” (IC-Pulse2020) on 10-12 February, 2020, Bhopal, Madhya Pradesh.

