Counting on beans: mungbean improvement in Asia

Key fact:

The transformation of mungbean from a marginal to a major crop in Asia has resulted in better nutrition for poor and anaemic women and children, improved soil fertility, and has provided poor farmers with a new income-generating opportunity.

Mungbean has been transformed from a marginal to major crop
(World Vegetable Center)

Summary:

The collaborative effort of AVRDC - The World Vegetable Center - and national partners, to research and develop improved mungbean varieties and technologies in order to resolve the major constraints limiting mungbean production in Asia, resulted in the release of improved varieties with short maturity duration, high yields, and disease resistance. Close to 1.5 million farmers across Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Sri Lanka, and Thailand have planted improved varieties across almost 3 million hectares. The average yield has increased around 300 kilograms per hectare.

The major beneficiaries of the intervention are the poor, especially children and women, whose diets lacked much-needed protein and iron. Supplementation with improved mungbean recipes has effectively improved low body iron stores in children and women. Both urban and rural consumers now have access to improved quality mungbean at reasonable cost. The crop offers the potential for increased income for smallscale farmers: improved mungbean varieties increased farmers' income by 45 per cent over local varieties in Bangladesh.

Facts & figures[1]

- 112 improved varieties have been released in 27 Asian countries.
- Improved virus–resistant varieties yield at least 2 tonnes per ha and mature in 55 to 65 days (compared to 400 kg/ha and 90-110 days maturity with traditional varieties).
- Due to the introduction of improved varieties, production of mungbean across Asia increased from 2.3 million tonnes to 3.1 million tonnes (35%) from 1985-2000.
- Globally, improved mungbean constitutes more than 25% of worldwide mungbean production.
- Improved varieties are grown on almost 3 million ha in Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand.
- High in protein and easy to digest, mungbean consumed in combination with cereals can thus significantly increase the quality of protein in a meal.
- Improved mungbean varieties contain 6 milligrams of iron per 100 grams of raw seed, whereas traditional varieties contain only 3.0 to 3.5 milligrams.
- Mungbean consumption has increased from 22-66% in various countries, and has been demonstrated to improve the health of anaemic women and children.
- The economic benefit to Pakistan in additional annual income was US$3.51-$4.21 million, primarily from women whose health improved from mungbean consumption.

Making the most of mungbean

High in protein and easy to digest, mungbean has long been important in Asian diets. But by the 1960s yields were stagnant or declining and, as the Green Revolution took off and focused efforts on improving production of staple grains, production of mungbean was relegated to marginal lands and cultivated with minimal inputs.

Today, however, through the collaborative efforts of AVRDC - the World Vegetable Center - and national partners, 112 improved varieties have been released in 27 Asian countries. The total area of improved varieties planted has reached almost 3 million hectares across Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Sri Lanka, and Thailand, providing farmers with average yield increases of around 300 kilograms per hectare. An estimated 1.5 million farmers planted improved mungbean across these nine countries alone, which constitutes more than 25 per cent of global production.

Researchers select desirable characteristics to improve mungbean *(World Vegetable Center)*

Traditional varieties of mungbean take 90-110 days to mature and are susceptible to pests and diseases, particularly the mungbean weevil and *Mungbean yellow mosaic virus (MYMV)*. Under SAVERNET (South Asia Vegetable Research Network), AVRDC scientists and national researchers screened and exchanged genetic material to identify desirable characteristics in order to improve mungbean. Although mungbean research showed spectacular success in Southeast Asia and China, the main region in need of improved varieties was South Asia, where MYMV severely constrained the crop's production.

In 1992, AVRDC established an informal network with scientists in Pakistan to develop improved, virus-resistant varieties for South Asia. From 1997, research identified varieties that would mature in 55 to 65 days and yield at least 2 tonnes per hectare for release in Bhutan, Bangladesh, India, Nepal, Pakistan, and Sri Lanka. By 2005, improved mungbean was being cultivated on 1.5 million hectares of land, and was used to diversify the rice-wheat system in the Indo-Gangetic Plains of South Asia.

Much of the credit for this success goes to the farmers who were active in the research and development of improved mungbean. They were instrumental not only in evaluating the improved varieties under farm conditions, but also in producing seed that could be shared with other farmers. For example, under a Seed Village Program launched in India's Punjab state in 2003, a total of 270 farmers, each planting mungbean on just 0.4 hectares of land, succeeded in producing about 2,700 tonnes of high-quality seed that was distributed to other farmers in the next season.

Today, improved mungbean varieties occupy almost 90 per cent of the area under mungbean cultivation in Pakistan and Thailand, 85 per cent in China, and around 50 per cent in Bangladesh and Myanmar, accounting for almost 3 million hectares of land (see table 1 below). Overall in Asia, production of mungbean varieties increased from 2.3 million tonnes in 1985 to 3.1 million tonnes in 2000. Globally, improved mungbean constitutes more than 25 per cent of worldwide mungbean production.

Mungbean is a major legume crop that supplements the largely cereal-based diets of the poor in Asia. When consumed together, cereals and legumes (also known as pulses) contribute significantly to a healthy and balanced diet. Cereals are deficient in the amino acid lysine, which legumes provide, whereas legumes are low in sulphur-rich amino acids, which cereals provide. High in protein and easy to digest, mungbean consumed in combination with cereals can thus significantly increase the quality of protein in a meal.

Mungbean also promises other health benefits for consumers, especially poor women and children, who are most vulnerable to the effects of poor nutrition and a lack of micronutrients in their diets. Mungbean is rich in iron, and improved mungbean varieties contain 6 milligrams of iron per 100 grams of raw seed, whereas traditional mungbean varieties contain only 3.0 to 3.5 milligrams. The productivity increase of anaemic female workers with enhanced iron availability due to improved mungbean varieties was estimated to be US$3.5 to US$4.2 million annually. The overall physical stamina of school children has also improved due to the intake of improved iron-rich mungbeans.

Mungbean has improved the nutrition of children *(World Vegetable Center)*

Through continuing research cooperation among local, national, and international partners to improve and share mungbean germplasm and technical expertise, smallscale farmers can increase yields, diversify crop rotations, and increase their incomes by growing this nutritious legume for their families and communities. Governments in Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand have all demonstrated a strong commitment to continue, strengthen, and sustain the gains made from the introduction of improved mungbean lines.

Table 1. Estimated area (ha) under mungbean before and after the intervention in different Asian countries

Country	Before intervention	After intervention
Bangladesh	15,000 (1985)	70,000 (2006)
China	547,000 (1984)	776,000 (2000)
India	284,500 (1980)	550,000 (2008)
Myanmar	43,000 (1980/81)	1,000,000 (1998/99)
Pakistan	100,000 (1985)	200,000 (2000)
Sri Lanka	14,000 (1980)	33,200 (1995)
Thailand	308,000 (1984)	335,000 (1995)

Source: Bangladesh, China, Pakistan, and Sri Lanka - Weinberger (2003a); India - Shanmugasundaram (2006); Myanmar - Bahl (1999); Thailand - Chainuvati et al. (1988) and Srinives (1998).

Testimonials:

- **Rajasthan, India:** Feedback from farmers on receiving improved mungbean variety SML 668, which grew uniformly in 60 days when no other crop would grow: “Your new variety is like God sent. We can not grow anything else at this time of the year. This mung variety gives us valuable pulse and also some pocket money. Please give us more seed.”

- **Jessore, Bangladesh**: During the dry season there was no other crop since the season was too short (60 to 65 days) and all the available varieties were long duration (85 to 90 days). But now during the dry season everywhere they have the improved mungbean varieties which mature in about 60 to 65 days. Farmers comment that they consume more mungbean now and they can get additional income from the crop. Improved health and increased income are the two benefits from growing the improved mungbeans.

Additional case study information

Costs and benefits:[2]

AVRDC research costs for mungbean for Asia from 1986 through 2000 have been estimated to be US$2.4 million (excluding the funding to other partners). The estimated producer and consumer surplus from 1986 to 2000 was US$20 million in Pakistan and US$129.9 million in China.

DFID contribution to research:

- DFID provided a grant of £150,000 to AVRDC from 1997-2000 to identify the best *Mungbean yellow mosaic virus* (MYMV) resistant early maturing mungbean lines for the six South Asian countries.
- Recognising the success of the initial effort, DFID provided a further £300,000 from 2002-2004 to AVRDC to diversify the rice-wheat cropping system in the Indo-Gangetic Plains of South Asia by introducing improved mungbean. This effort raised incomes of smallscale farmers and improved nutrition for vulnerable children and women through greater bioavailability of iron in diets.
- DFID funding over the years to support development of new mungbean varieties was extremely important in the progress of this research.
- Mungbean forms an important component of a DFID RIU-funded project in Nepal which will promote double cropping - growing a legume crop after the main rice harvest - to raise productivity and help reduce rural poverty. Collaboration with the private sector and NGOs in Nepal will be vital for the success of the programme.

Research milestones:

- 1972 AVRDC identifies mungbean as a mandate crop and launches a mungbean improvement programme.
- 1992 AVRDC establishes an informal network with scientists in Pakistan, which enables scientists to develop improved MYMV-resistant varieties for South Asia.
- 1997 With support from DFID, South Asian members of SAVERNET (South Asia Vegetable Research Network) organise a sub-network to disseminate virus-resistant varieties.
- 2002 DFID approves a two-year project to help farmers diversify rice-wheat rotations by adopting improved mungbean cultivars. Farmers active in the research and development of improved mungbean not only evaluate improved varieties but produced seed to share with other farmers.

Photo credits:

World Vegetable Center: For high res images contact Maureen Mecozzi (Maureen.mecozzi@worldveg.org). Additional photos can be accessed at: http://picasaweb.google.com/wvcmecozzi/MungbeanFromDrBains?authkey=Gv1sRgCKSs6YjZjIiGWg&feat=directlink

Links:

The World Vegetable Center: www.avrdc.org

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DFID Department for International Development

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