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New Varieties and Improved Production Technologies in Mungbean: Achievements and Future Outlook in India

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Among the various pulse crops, mungbean remains an attractive crop owing to its suitability to a range of cropping systems. With the concerted scientific efforts devoted to mungbean improvement over the last five decades, availability of photo- and thermo-insensitive varieties coupled with shortening of the maturity duration have helped greatly in introducing this crop into previously unexplored cropping systems such as rice-wheat and rice-rice systems. This article outlines the impacts of the recent agricultural technologies in mungbean and the future directions to realize the anticipated gains.

Introduction

Mungbean [*Vigna radiata* (L.) Wiczek] is the most important crop in the *Vigna* group. In India, it is widely cultivated across different seasons; however, *Kharif* cultivation has the greatest share, mostly intercropped with a variety of crops including sorghum, pearl millet, maize, cotton, castor, pigeonpea. Exquisite attributes like extremely plastic morphology, phenology and short maturity duration (< 60 days) make mungbean an ideal option for catch cropping, inter cropping and relay cropping. During rabi season, it is grown as a sole relay crop in rice fallows in states like Andhra Pradesh, Tamilnadu, Karnataka and Orissa, whereas it is a popular sole catch crop during spring/summer season in other states such as Uttar Pradesh, Bihar, Jharkhand, Punjab, Haryana and Rajasthan. Across India, it serves as a multi-purpose crop and being used as *dal*, curries, soup, sweets and snacks. Additionally, mungbean sprouts are increasingly becoming the popular component in vegetarian diets.

Indian Scenario

Concentrated crop improvement efforts in past has registered substantial increase both in area and production over the last four decades in mungbean (Fig. 1). The area has increased from 2.10 million ha in 1970 – 75 to 3.38 million ha in 2011-12, and it has now become the third most important pulse crop in the country following chickpea and pigeonpea. The production has increased from 0.64 million tonnes to 1.63 million tonnes during the same period. This expansion in area is primarily credited to the availability of relatively photo and thermo insensitive varieties, thereby allowing a greater flexibility in their planting dates. Also short duration varieties were developed which could accommodate well in a wide range of cropping systems. The area covering winter mungbean under rice fallows and spring/summer mungbean has also been expanded substantially. Ample scope is there to bring additional 3-4 million ha are of mungbean into rice – wheat and rice – rice cropping systems, however, to facilitate this an enhanced seed supply chain of improved varieties is certainly required.

In India, the varietal development scheme in mungbean was initiated at the Imperial Agricultural Research Institute (now known as Indian Agricultural Research Institute) in the early 20th century. Subsequently, a number of important varieties were developed based on selection from the local material or land races. Predominantly, these varieties were indeterminate, late maturing with tremendous vegetative growth and showed susceptibility to various diseases including mungbean yellow mosaic virus (MYMV), powdery mildew (PM), and Cercospora leaf spot (CLS). With the inception of All India Coordinated Pulses Improvement Project in 1967 systematic and concerted efforts were undertaken with the objective to deliver high yielding varieties with wider adaptability and better suitability to the production technology.

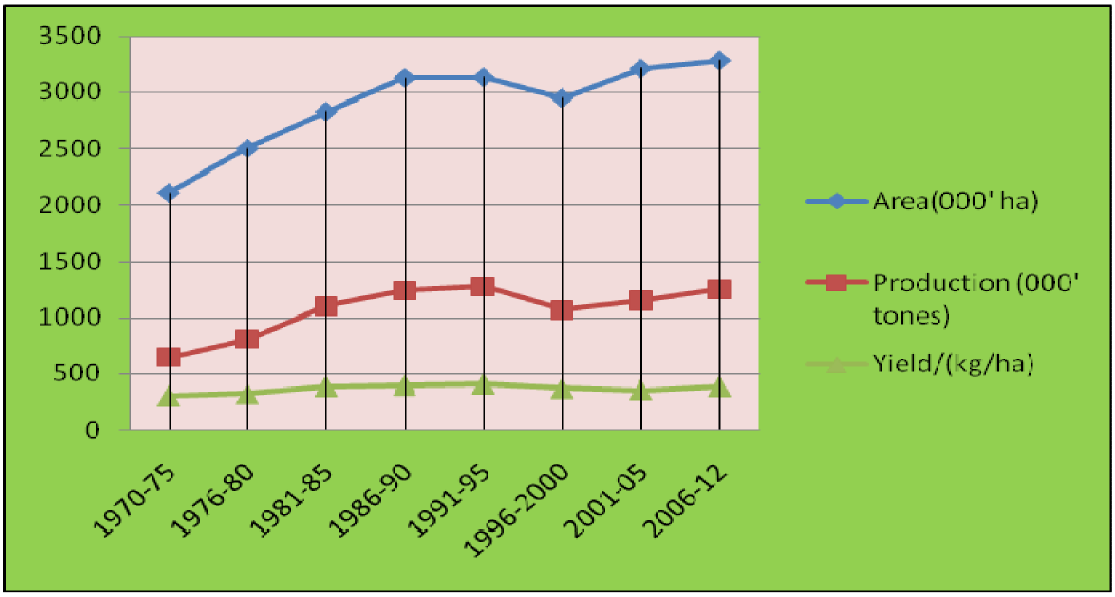

Fig.1. Mungbean Area, Production and Productivity Trend in India

The varietal development aimed at accumulating the desirable traits for agronomic traits and resistance to diseases/pests through exploiting the diverse sources using hybridization and selection cycles. As a consequence, several high yielding and short duration varieties were developed which additionally had resistance to important diseases (Table 1). Some of the recently developed varieties like Samrat, Pusa Vishal, Meha, Pant Moong 5, SML 668, HUM 16, TM 96-2, IPM 02-3 have played catalytic role in bringing additional area under spring/summer and rabi season mungbean, thereby radically enhancing the seed demands for these varieties. The mungbean varieties described above hold the major share in the breeder seed indent, which has increased almost four times over the last two years. An additional expansion in mungbean acreage may be realized in near future owing to the growing recognition of these varieties.

Table 1: Recently developed varieties of mungbean in India

Trait	Varieties
Short duration for spring/summer cultivation	Samrat, Pusa Vishal, Meha, TMB 37, Pant Moong 5, SML 668, HUM1, HUM 16, IPM02-3, IPM 02-14
Large seed size	Pusa Vishal, Pant Moong 5, SML 668, HUM 16, TMB 37, IPM02-3
Resistant to PM for rabi season.	TM 96-2, Vamban 2, Vamban 4, TARM 18, BPMR 145
Resistant to MYMV	Samrat, Meha, Pant Moong 4, MH 2-15, Narendra Moong 1, Pant Moong 6, HUM 1, HUM 12, IPM 02-3, IPM02-14

Scenario in Rajasthan

Over the past two decades, the extensively undertaken research attempts have led to the development of a range of high yielding varieties with short duration and MYMV resistance, such as IPM 02-3, Pant Moong 5, RMG 268, Ganga 8, Pusa Vishal and MH 2-15.

Table 2: Improved varieties of mungbean recommended for Rajasthan

Season	Name of varieties
Kharif	MUM 2, Ganga-8, RMG 268, MH 2-15, IPM 02-3, SML-668, RMG- 492, ML-818
Spring/Summer	RMG 268, SML-668, PDM-139, Meha

The varieties listed in Table 2 have indeed helped in enhancing the area and the production. In Rajasthan, the area under mungbean has increased from 271.0 thousand ha to 959.49 thousand ha during 1970-75 to 2000-05 which in turn witnessed a remarkable growth in production from 66.8 thousand tones to 404.64 thousand tones (Fig. 2). As a result, accessibility to quality seed resulted in the expansion of the area and total production. Unlike to the upward trend as has been seen in case of area and production, considerable fluctuations were noticed in productivity (113.0 kg/ha 1986-87 to 509.0 kg/ha during 2011-12) which may primarily be attributed to the erratic rainfall during the crop season. The state has tremendous potential to witness a quantum leap in the mungbean production if a sincere effort is being made to further popularize the new production technologies.

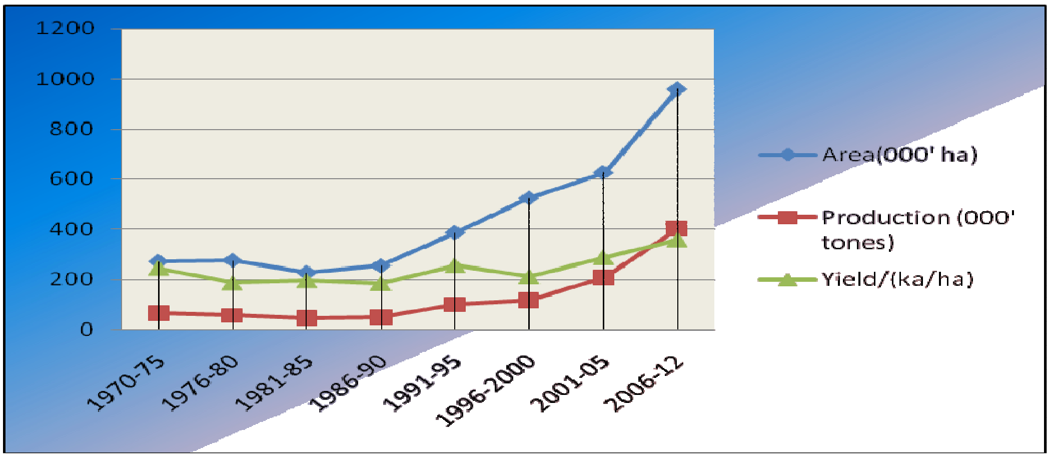

Fig.2. Mungbean Area, Production and Productivity Trend in Rajasthan

Transfer of Technology

More than 600 front line demonstrations (FLDs) were executed to underscore the production potential of newly released high yielding varieties during 2007-13 in *Kharif* season at farmers' fields. The results from demonstrations clearly indicated up to 21 % yield advantage of improved varieties over the local varieties grown by farmers. Noticeably, the recommended application of critical inputs like sulphur @ 20 kg/ha has shown 15.67% growth in average yield across 43 FLDs. Similarly, nearly 13% increase in productivity was noticed across 73 *Kharif* trials which were conducted to examine the impact of seed inoculation with efficient *Rhizobium* strains. Concerning management of obnoxious weeds, pre-emergence application of pendimethaline @ 1.25 kg a.i/ha positively affected the grain yield with an increase of 19.40% in yield. Similarly, 82 *Kharif* demonstrations were organized that aimed to assess the advantage of IPM technology over farmers' routine practices and as a result, the average grain yield was increased by almost 14%. To realize the full potential of the improved technologies, it is imperative to increase focus on rapid dissemination of the newly-developed technologies and the timely supply of the critical agricultural inputs enabling the most efficient execution.

In context of Rajasthan, a total of 100 demonstrations were carried out using improved varieties in *Kharif* season during 2007-13. The data recorded on trials conducted at farmers field revealed up to 29% yield advantage that could be achieved by the use of improved varieties. Similarly, ten demonstrations were laid out by Durgapura centre on weed management aspect using a variety RMG 492, and about 28.98% increase in yield was recorded. Likewise, data collected from five FLDs showed 14.35% grain yield advantage by inoculating mungbean seeds with *Rhizobium culture*. With regard to IPM technology, total 24 trials were conducted, and 19.01% increase in grain yield was observed. The encouraging results noted across various FLDs covering various aspects like IPM modules and *Rhizobium* inoculation indicate towards strengthening our focus on transfer of available technology to farmer field so that the transformational achievements could be practically met in mungbean production and productivity in the coming years.

Conclusion

Number of high-yielding, short-duration and resistant/tolerant varieties and other technological innovations including IPM and *Rhizobium* inoculation were made accessible to the use by the farming community. The assessment of impacts of these new technologies at farmer fields is done regularly using FLD approach which has produced exciting results. However, rapid dissemination of the generated scientific knowledge (new cultivar or agricultural technologies) to the famers' field is urgently required in order to capture the tremendous potential of these newly-established technologies. Accordingly, renewed focus need to be developed towards the technology dissemination outlined here. More importantly, rapid adoption of the new technologies will indeed be immensely rewarding to the farming community.