

Summer mungbean

for doubling farmer's income and livelihood security

**Rajesh Kumar*, Atar Singh, C P Nath, C M Tripathi, C S Praharaj,
S K Dubey and N P Singh**

Indian Institute of Pulses Research, Kanpur, Uttar Pradesh 208 024

Legumes are known to increase the soil fertility through their capacity to fix atmospheric-nitrogen and hence the soil fertility can be improved by inclusion of a legume in the cropping system. Yield of cereals following legumes are reported to be 30-35% higher than those following a cereal in cropping sequence. Results revealed that summer mungbean cultivation (April–June) as a sequential partner of rice-wheat and maize-wheat systems under assured irrigation facility increased system productivity and cropping intensity. In this article, the potential benefits of introducing summer mungbean in farmers field through farmers FIRST project are highlighted.

Key words: Farmer First Programme, Legumes, Livelihood security, Mungbean

SUMMER MUNGBEAN cultivation under Farmers FIRST programme by covering 550 farmers in Fatehpur district of Uttar Pradesh provided additional farmers income and net returns. The average yield of mungbean was 0.95 t/ha in farmers' field of Fatehpur district. Besides, farmers fetched additional income of ₹ 19310/ha with mungbean cultivation during summer season. Moreover, mungbean cultivation in the area, where no crops were grown earlier resulted in employment generation in village. Hence, introducing summer mungbean for high intensive systems is needed for maximizing land productivity, long-term sustainability, and farm profitability. Thus, inclusion of mungbean can be the future of agricultural change and an approach for doubling farmer's income.

Need for summer mungbean cultivation

India produces a quarter of the world's total pulses, accounting for one-third of the total global acreage under pulses. Indians consume 30% of the world's pulse production. The

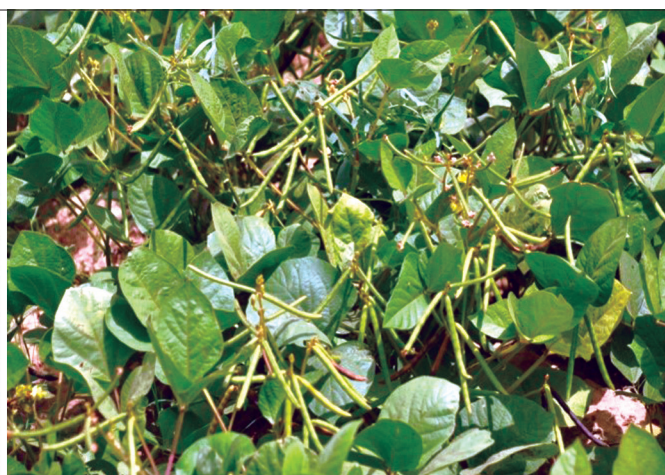
domestic production of pulses has not kept pace with population growth and has grown at only 1% from 1951–2012 compared to a population growth of about 2%, during the same period. Indians today are consuming far less (33 gm/head/day) pulses than they used to have earlier (>65 gm/head/day). During the post Green Revolution era, both the area and production of pulses in India has declined. Although the productivity of total pulses has increased from 654 kg/ha to 896 kg/ha during the 3 decades, overall production has shown a significantly declining trend due to reduction in area under pulses. Being the primary and cheap source of our dietary protein, the demand of pulses in India is escalating. The huge gap between the demand and production of pulses in India has widened over a period of time, resulting in deficiency of protein and micronutrient malnutrition. It is a fact that "rice-dal" is the daily dish of majority of the low-income people of the country and hence has become inevitable for their nutritional

security. Pulses are known to be the "House of Nutrients" to support human and animal health and therefore, assured availability of pulses at an affordable cost through enhanced production enables the farmers and people to sustain their nutritional security. There exists a huge gap at national level in the demand and supply of pulses. Recently, pulse production is gaining importance to meet the self sufficiency and domestic demand. The approaches for increasing pulse production are: increase in productivity and/or bringing additional area under pulses in new niches.

Long-term cultivation of cereal-cereal cropping systems is now resulting in declining total factor productivity and sustainability. In the coming years with increasing pressure of population, the problem will be much more serious. Therefore, we have to move towards a more productive as well as sustainable production system. Rice-wheat and maize-wheat are the two leading cropping systems in India



IPM 2-14 (2016-17)



IPM 2-3 (2017-18)

Performance of summer mungbean in demonstration field of Fatehpur district of U.P.

contributing major share of the total food grain production. Mungbean (*Vigna radiata* L.) being a short duration crop (60-65 days) can be easily accommodated in irrigated rice-wheat and maize-wheat production system during summer season. Apart from the yield advantage of mungbean crop, the crop being a legume, provides the additional benefits of system diversification, maintenance of soil health, and often used as a source of green manure.

Intervention through Farmer FIRST Project for summer mungbean

Three villages: Kharauli, Mirai, and Karchalpur from Devmai block of Fatehpur district in Uttar Pradesh were selected for implementation of the Farmer FIRST project. The distance of project area from Indian Institute of Pulses Research, Kanpur is about 45 km. The villages are in one cluster connected to each other. The crop history of the village is particularly rice, maize, pearl millet, sorghum, pigeonpea during rainy season and wheat, mustard, toria, chilli, bean, potato in winter season. Predominantly, rice-wheat and maize-wheat cropping systems are followed in the villages. Vegetables have more scope as better market is available at a distance of 30 km in Kanpur city. Summer mungbean intervention was implemented in project area by covering 315 farmers in 2016-17 and 2017-18 for additional income and to generate additional employment during season in village itself. The

project was implemented through visiting the adopted villages and interaction with farmers, organizing meetings of farmers in each of selected village. The data on yield, income, and employment generation were collected with objective: to increase yield and net return of farmers through crop enterprises, to develop capacity of farmers in enhancing crop and system productivity and sustainability in project area, and to strengthen institutional linkage for seed production system and value addition of pulses.

Demonstration of IPM 2-14 variety of mungbean in 2016-17

Summer mungbean intervention was implemented in project area by covering 273 farmers in 53 ha area with IPM 2-14 variety of mungbean in 2016-17. The local variety of mungbean used by the farmers was also kept for comparison. The average yield of mungbean was 0.95 t/ha with additional income of ₹ 19310/ha and employment generation of 2-3 h per day (60-90 h/month).

Demonstration of IPM 2-3 variety of mungbean in 2017-18

In 2017-18, summer mungbean intervention was implemented in project area by covering 42 farmer in 20 ha area with IPM 2-14 variety of mungbean. The average yield of mungbean was 1.02 t/ha with additional income of ₹ 20780/ha and employment generation 2-3 h per day (60-90 h/month).

Component crops yield and system productivity

Summer mungbean inclusion in rice-wheat cropping system increased rice and wheat yield by 12.3 and 6.7%, respectively. A good harvest of summer mungbean (0.9-1.2 t/ha) was also realized under lowland rice-wheat-mungbean rotation. Similarly, under upland maize based system with inclusion of summer mungbean, maize yield increased by 17.2% while the corresponding increase for *rabi* season wheat was almost 8.0%. An average additional yield of 1.0 t/ha (2016-17 and 2017-18) of summer mungbean was recorded. System productivity with reference to mungbean equivalent yield was computed 2.43 t/ha. Therefore, in long-term, system diversification through summer mungbean not only increased the system productivity but was equally effective in increasing the yield of the component cereal crops of the system. The residual effect of summer mungbean was found more prominent for the immediate *khharif* season cereals and less residual effect was observed for *rabi* season wheat in both the systems.

Profitability in summer mungbean cultivation

Economic assessment of the present study was done based on net profit and benefit:cost ratio. The economics of the end product was calculated by minimum support price (MSP, GoI) of the component crops. The cost of cultivation includes field preparation, sowing, harvesting,

threshing, weeding, and input (labour, irrigation, fertilizer, chemicals) cost. The results indicated that the higher economic return was realized with improved varieties compared to the local varieties. Being a short duration leguminous crop, input requirement and cost of cultivation for mungbean is lower than the cereals that leads to a higher net return (Table 1).

Foliar nutrition and insecticide application in mungbean

Under farmer FIRST project, quality seed was provided which is resistant to yellow mosaic viruses (YMV). The incidence of YMV disease is common in the studied area. Spraying of micronutrient at flowering stage of mungbean resulted in the higher yield of mungbean (21-23%) compared to without spray in mungbean. Insecticide was sprayed for controlling the sucking pest i.e. thrips. Thrips damage the crop at flowering stage by sucking of plant sap and reduce the yield up to 15-20% commonly. The yield increased up to 15-18% with spraying of imidacloprid compared to no spray (Table 2).

Capacity building of farmers for crop intensification and income augmentation

Demonstration of improved technologies and varieties was conducted at farmer's field in an effective way to impress upon the farmers for technological advancement linked enhanced pulse production. This not only educated the farmers for adoption of new

Table 1. Yield and economics of mungbean cultivation under Farmer FIRST project in Fatehpur district

Year	Variety	Yield (t/ha)	% yield increase over local	Cost of cultivation (INR)	Gross income (INR)	B:C ratio
2016-17	IPM 2-14	1.02	23.0	15760	36540	2.31
	Local variety	0.82	—	14950	29700	1.98
2017-18	IPM 2-3	0.95	20.3	14890	34200	2.29
	Local variety	0.79	—	13450	28440	2.11

Table 2. Participatory demonstration of effectiveness of micronutrients and insecticide on mungbean in farmers field of Fatehpur district

Intervention	Yield (t/ha)	% yield increase	Intervention	Yield q/ha	% yield increase
Micronutrient spray	1.02	23.0	Insecticide spray	0.92	16.6
Without spray	0.8		Without spray	0.70	

technology but also helped enhancing the seeds replacement rate for the new varieties for better yield per unit area per unit time. Pulses are grown by the farmers in the state following their age old practices casually using locally available cultivars. Introduction of improved varieties along with package of practices was demonstrated in a farmer-participatory approach. Use of micronutrient, appropriate seed rate, seed priming, timely sowing, insecticide spray was followed. Farmer training, demonstration, and field visit was organised to build up the capacity of the farmers, extension workers, and women. It certainly empowered and encouraged the farmers to go for enhanced cultivation of pulses which ultimately augmented the total pulse production in the village. The resource persons of the institute, state government, other national/international organisations visited the project site and interacted with farmers for capacity building.

Employment generation and women empowerment

As majority of the farmers of the selected districts and villages were small and marginal farmers, the additional income from mungbean cultivation benefitted the resource poor farmers. In order to retain contiguity and in the better interest of technology dissemination, a few large farmers were also targeted. Mungbean cultivation resulted in the 300% cropping intensity as compared to the 200% previous cropping intensity (rice-wheat/maize-wheat). It resulted in the employment generation of 2-3 h per day (60-90 h/month) in the villages. Importantly, women were inducted in the agricultural activities such as weeding, picking of pods, threshing, and winnowing operations with mungbean cultivation.

Effects on soil fertility

Soil samples were analysed from farmers field and indicated that



Farmers and Scientists interface on summer mungbean cultivation



Employment generation and women empowerment through summer mungbean cultivation

growing of summer mungbean after rice-wheat and maize-wheat system improved the soil health. In rice based system, continuous cultivation of summer mungbean followed by rice-wheat significantly improved soil available nitrogen (N), phosphorus (P), and sulphur (S). Among the micronutrients, DTPA extractable Zn significantly increased with summer mungbean inclusion. Highly intensive rice-wheat-mungbean rotation increased soil organic carbon (SOC) by 12.5% over continuous cultivation of rice-wheat. Similarly in

upland maize-wheat system, with inclusion of summer mungbean, the greater increase in soil available P, K and S was noticed whereas the improvement of available N was moderate/marginal. Beside nitrogen fixation, mungbean also helped in solubilization of P, increase in soil microbial activity, organic matter restoration and improvement of physical health of soil.

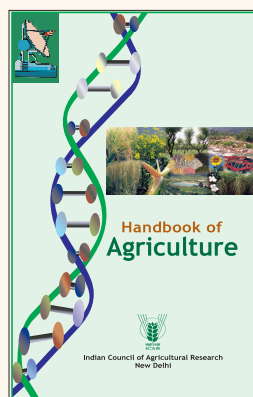
SUMMARY

Increasing the land productivity with highly intensive cropping

system is the need of the day to meet the growing demand of food grain. Rice-wheat and maize-wheat systems contributing the major share in food grain production are now facing the problem of decline in factor productivity with reduction in farm income. Introducing summer mungbean after harvesting of wheat is a potential option for increasing system productivity and long-term sustainability in these cereal based production systems. India accounts for 79% (11.65 million ha) of the total rice fallows of South Asia (15.0 million ha). Rice fallows are mainly spread in the states of Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, West Bengal, and Uttar Pradesh. These states are embedded with one of the extensive agro-production systems of South Asia. Therefore, increasing cropping intensity with mungbean cultivation to ensure higher yield with a sustainable ecosystem will be a great service.

*Corresponding author e-mail: rajeshk3022@gmail.com

Handbook of Agriculture



The Handbook of Agriculture is one of the most popular publication of the ICAR with a wider readership. The present edition presents science-led developments in Indian agriculture, the ongoing research efforts at the national level and with some ideas on the shape of future agriculture. While information in some chapters such as Soil and water, Land utilization, field and forage crops has been updated with latest developments, many new topics such as the Environment, agrobiodiversity, Resource conservation technologies, IPM, Pesticides residues, Seed production technologies, Energy in agriculture, informatics, Biotechnology, Intellectual Property Rights, Agricultural marketing and trading and Indigenous Technical Knowledge have been included in the present edition. For those who take intelligent interest in agriculture – and their number is increasing fast – the present edition would serve as a useful book.

TECHNICAL SPECIFICATIONS

Size : Royal Octavo (16 cm x 24 cm) • No. of pages : i-xii + 1618 • Price : Rs 1500 • Postage : Rs 100
ISBN No. : 978-81-7164-096-6

For obtaining copies:

Business Manager

Directorate of Knowledge Management in Agriculture
Indian Council of Agricultural Research
Krishi Anusandhan Bhavan-I,
Pusa, New Delhi 110 012
Tel : 011-25843657, Fax 09-11-25841282;
E-mail : bmicar@icar.org.in