

## Effects of various technological interventions on summer moong (*Vigna radiata* L.) in Chhattisgarh Plain area of Madhya Pradesh

### Abstract

The field demonstrations were laid out at 30 farmers (12.0 ha area) during 2018, 2019 and 2020 to examine the impact of various technological interventions on summer moong. In this intervention, PDM 139 variety of moong bean was sown by using seed drill during 10<sup>th</sup>-20<sup>th</sup> April of each year with 25 kg/ha seed rate and treated with Thiram @ 3 g/kg of seed and Rhizobium culture 10g/kg seed. Pendimethylene @ 1.5 kg/ha was applied for weed management, whereas urea 27.5kg/ha and SSP of 250 kg/ha was applied as fertilizer doses. Farmers practice kept as check for comparing the impact of intervention on moong bean yield and economic returns. Results of the study revealed that, the crop yield was increased by 50.0, 43.9 and 44.0% under intervention over farmers practice during 2018, 2019 and 2020, respectively. Mean of the technology gap was 3.13 q/ha and mean extension gap was 2.16 q/ha. Whereas, technology index was observed 0.31 during the demonstrations. Economic returns showed significantly improved under intervention during all the years as compared to the farmers practice. B:C ratio was 1.88 under intervention during 2019, which was higher compared farmers practice in all the years.

**Keywords:** Moong bean, Production, Intercropping, Technology gap, Extension gap, Technology index.

### Introduction

Moong bean is the mature fruit seed of (*Vigna radiata* L. Wilczek) cultivated in India, Burma, Srilanka, Pakistan, China, Fiji, Queensland, Thailand, Philippines, Vietnam, Indonesia, Malaysia, Korea and Africa. India is the biggest producer of Moong bean where about 3.83 million ha are cultivated with 1.60 million tons production [1]. In case of Indian states, it is widely cultivated in Orissa, Maharashtra, Andhra Pradesh, Madhya Pradesh, Gujarat, Rajasthan and Bihar. Moong bean and urdbean are the excellent sources of high quality protein and mineral [2, 3, 4]. The seeds have high (28%) protein content that is easily digestible, are easy to cook and lack flatulence factors in contrast to other legumes [5,6]. Moong bean is a rich source of protein (14.6– 33.0 g/100 g) and iron (5.9–7.6 mg/100 g) [7]. Moong bean contains 1- 3% fat, 50.4% carbohydrates, 3.5-4.5% fibers and 4.5-5.5% ash, while calcium and phosphorus are 132 and 367 mg per 100 grams of seed, respectively

**Comment [u1]:** Please make your research gap clear. The application of technological techniques created a change. What was the initial production methods?. Create a relationship between them

[8,9]. Moong bean is consumed as whole grains, sprouted form as well as dhal in a variety of ways in homes. It is also used as green manuring crop. Moong bean can be used as a feed for cattle even husk of the seed can be soaked in water and used as cattle feed. In India, these crops are cultivated in three different seasons, viz., kharif, rabi and summer. Summer Moong bean can be grown after harvesting of chickpea, lentil, pea, potato, mustard, wheat and cotton. After paddy –wheat crop rotation, soil fertility can be improved by cultivation of Zaid Moong bean. Under this study, improved variety, seed treatment, recommended dose of fertilizers/ biofertilizers, weed management and plant protection management techniques were studied for increasing production of summer Moong.

**Comment [u2]:** Why are you using this method? Was there low yield over period, was there toxic in the other method adopted? Why are you adopting this method?

## Materials and Methods

Present study was conducted during the summer season of the year 2018, 2019 and 2020 in adopted villages (Koppe, Lendijheri and Chillod) of district Balaghat under the FarmerFIRST project, College of Agriculture, Balaghat. The soil of the district is generally sandy loam in texture [10, 11, 12]. The district was bounded by 21° 19' to 22° 24' N Latitude and 73° 31' to 81° 30' E Longitude with an altitude of 330m above sealevel (masl) (Sarvade *et al.*, 2020). Climate of the district is sub-tropical characterized by a hot summer and general dryness except during the southwest monsoon season. The normal annual rainfall of Balaghat district is 1294.5 mm. Maximum temperature (43°C) recorded during the month of May and minimum (8° C) during the month of December [13, 14, 15].

A total 12.0 ha area was covered under the demonstrations (4.0 ha in each year). The demonstrations were conducted in the field of 30 farmers in the area of 0.4 hectare each. In demonstration fields, moong crop was grown according to the package of practices (Anonymous, 2017). In demonstration, quality seeds of improved variety, seed treatments, recommended dose of fertilizers, weed management and plant protection management techniques were demonstrated on the farmer's field through front line demonstration (Table 1). The demonstrations were laid out in Randomized Block Design (RBD) with 3 replications. The conventional practices were maintained in case of local checks. Opinion of the farmers about technologies used under demonstration was collected for further improvement in research and extension activities. The data were collected from front line demonstration's fields as well as from control field (farmers practices) and finally the technology gap, extension gap, technology index were calculated as formula given by Samui *et al.* [16] and Henderson and Tilton [17] as follows:

Technology Gap = Potential yield – Demonstration yield

Extension Gap = Demonstration yield – Farmer's yield

Additional Return = Demonstration Return - Farmer practices return

Technology index = Potential Yield- Demonstrated Yield/Potential Yield

The results were analyzed statistically using analysis of variance ( $P=0.05$ ) ANOVA as described by Gomez and Gomez, [18].

## Results and Discussion

### *Yield of summer moong*

Technologies undertaken in demonstration fields and practices adopted by farmers in control are presented in Table 1, and revealed that the farmers were not adopted a single recommended practice in moong crop as considered marginal crop by the farmers. The grain yield of moong under front line demonstrations recorded as 6.75 q/ha, 6.88q/ha and 6.96 q/ha, however in farmer's practice grain yield recorded as 4.50 q/ha, 4.78q/ha, and 4.83 q/ha in the year 2018, 2019 and 2020, respectively. Significant higher mean grain yield (6.86 q/ha) was recorded under intervention as compared to farmer practices (4.70 q/ha) (Table 2). In recommended intervention, there was increase in grain yield of moong that 50, 43.9 and 44.0 % during the respective year (2018, 2019 and 2020). The demonstrated medium duration moong variety i.e. PDM 139 in Krishi Vigyan Kendra, JNKVV, Narsinghpur, Madhya Pradesh and reported 24% increase in the average moong bean yield [8, 19].

Mean technology gap was 3.13q/ha and extension gap was 2.16 q/ha. Mean technology index was 0.31. According to these results, farmers need to convince for adoption of the new suggested technology for increasing yield of the summer moong bean. Kumar and Boparai [20] studied impact of frontline demonstrations on summer moong crop conducted in Jalandhar district of Punjab and reported that recommended varieties, seed rate, timely sowing and plant protection technology resulted in average increase in yield of 18.73 per cent in summer moong over the check plots [21, 22].

It is observed that in general average potential yield gap between FLD and farmer's local check yield is about 27%. The potential yield level could be obtained by adoption of improved package of practices. Front Line Demonstration conducted on Mung bean crop with improved variety PDM 139 in Madhya Pradesh the improved practice yield was 6.86 q/ha and farmer's yield was 4.70 q/ha. The results revealed the increase in yield over check was 45.9 %. From the table 2, it is clearly seen that moong productivity is higher under intervention as compared to farmer practice [23, 24, 25]. Based on the above criteria for Madhya Pradesh has potential for increasing production of moong bean by adoption of recent technologies. In Madhya Pradesh, moong bean production can be increased in five years by reducing 10% yield gap every year.

**Comment [u3]:** How did you carry out your research during covid-19? What labour force did your institution use? Visible or invisible?

**Comment [u4]:** This point needs to be reflected in your abstract and introduction.

### ***Economic returns***

The cost of cultivation in farmers practice was increased from Rs. 20500/- in 2018 to Rs. 22600/- per ha in 2020. In case of demonstrated intervention, it was increased 8.98% in 2018, 14.51% in 2019 and 18.71% in 2020. Gross and net return in farmers practice was also increased from Rs. 25087/- and Rs. 4587/- per ha in 2018 to Rs. 34051/- and Rs. 11451/- per ha in 2020, respectively. Gross return in demonstrated intervention was increased 33.33% in 2018, 30.52% in 2019 and 30.60% in 2020. Net return also increased in demonstrated intervention as 69.64% in 2018, 48.68% in 2019 and 46.16% in 2020. B:C ratio was improved under demonstrated interventions in all years of an experimentation. Highest B:C ratio was observed in demonstrated intervention in 2019. Patel *et al.*, [8] also reported similar results such as front line demonstration recorded higher gross return and net return as compared to local check [26, 27, 28].

### **Conclusions**

During the Covid 19 period, the demonstrations were laid out and findings were concluded as the grain yield of the moong bean was increased under intervention. Extension of the technology knowledge was given to the farmers, but the gap in technology adoption by the farmers is the concerning issue for the farming communities. During 2018, the percent increase in gross and net return was higher as compared to the year 2019 and 2020.

**Table 1: Difference between technological intervention and farmers practices for moong crop**

S.no	Particular	Technology Interventions	Farmers Practice
1.	Variety	PDM 139	Local variety
2	Seed rate	25 kg/ha	20 kg/ha
3	Seed treatment	Thiram @ 3 g/kg of seed	Not applied
4	Rhizobium culture	10g/kg seed	Not treated
5	Time of sowing	10-20 <sup>th</sup> April	25-30 <sup>th</sup> April
6	Weed management	Pendimethylene@ 1.5 kg/ha	Not applied
7	Fertilizer dose	Urea: 27.5kg/ha and SSP: 250 kg/ha (On soil test basis)	Irrational use of nitrogenous fertilizers and nonapplication of DAP
8	Method of fertilizer application	Fertilizers drilled at the time of sowing	Broadcasting
9	Insect-pest management	Need based spray of insecticide at Economic threshold level (ETL)	Overdoses/ un recommended brands of insecticide

**Table 2: Grain yield and gap analysis of demonstration intervention in summer moong**

Year	Area (ha)	No. of farmers	Yield (q/ha)			Increase over farmer practices (%)	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			Farmers Practice	Intervention	Potential				
2018	4	10	4.50	6.75	10.0	50.0	3.25	2.25	0.33
2019	4	10	4.78	6.88	10.0	43.9	3.12	2.10	0.31
2020	4	10	4.83	6.96	10.0	44.0	3.04	2.13	0.30
<b>Mean</b>	<b>4</b>	<b>10</b>	<b>4.70</b>	<b>6.86</b>	<b>10.0</b>	<b>45.9</b>	<b>3.13</b>	<b>2.16</b>	<b>0.31</b>

**Table 3. Economics of demonstrated intervention in summer moong**

Particulars	Year 2018		Year 2019		Year 2020	
	Intervention	Farmers Practice	Intervention	Farmers Practice	Intervention	Farmers Practice
<b>Cost of cultivation</b>	22522 (8.98)	20500	25500 (14.51)	21800	27800 (18.71)	22600
<b>Gross Returns</b>	37631 (33.33)	25087	47988 (30.52)	33,340	49068 (30.60)	34051
<b>Net returns</b>	15109 (69.64)	4587	22488 (48.68)	11,540	21268 (46.16)	11451
<b>B:C ratio</b>	1.67	1.22	1.88	1.52	1.76	1.50

Values in parenthesis are % data increase over farmers practice;

MSP price of summer moong is in year 2018= Rs. 5575/q; year 2019 = Rs. 6975/q; year 2020= Rs. 7050/q

**Comment [u5]:** I suggest these come after references

## References

1. Anonymous. 2016. *Annual Report-AICRP on MULLaRP 2015-16*. BCKV. 54p.
2. Gangwar A, Jadhav TA, Sarvade S, 2012. Performance of spring planted urdbean varieties as influenced by dates of planting. *Environment and Ecology*. 30(4):1563-1566.
3. Gangwar A, Jadhav, TA, Sarvade S. 2013. Productivity, nutrient removal and quality of urdbean varieties planted on different dates. *Bioinfolet*. 10(1A):139-142.
4. Thakur Risikesh and Sawarkar S.D. (2009). Influence of long term continuous application of nutrients and spatial distribution of sulphur on soybean-wheat cropping sequence. *Journal of Soils and Crops* **19**, 225 – 228.
5. Sahoo, L., Sugla, T. and Jaiwal, P.K. (2003). In vitro regeneration and genetic transformations of *Vigna species*. In: Jaiwal, P.K., Singh, R.P. (eds.) *Biotechnology for the improvement of legumes*. Kluwer AcadPubl, Netherlands, pp. 1-48.
6. Thakur Risikesh, Sharma G.D., Dwivedi B.S. and Khatik S.K. (2007). Chromium: As a Pollutant. *J. of Industrial Pollution Control*, 23(2): 197-203.
7. Dahiya, P. K., A. R. Linnemann, M. A. J. S. Van Boekel, N. Khetarpaul, R. B. Grewal and M. J. R. Nout 2015. Mung Bean: Technological and Nutritional Potential. *Crit Rev Food Sci Nutr*. 55 (5):670-88.
8. Patel Neerja, VermaNidhi, Sahare K.V., Sharma Aashutosh and Sharma S.R. 2022. Impact of CFLD on production and productivity of summer moong. *International Journal of Agricultural Sciences*. 18(1): 69-72.
9. Sharma Y.M., Jatav R.C., Sharma, G.D. and Thakur Risikesh (2013). Status of Micronutrients in Mixed Red and Black Soils of Rewa District of Madhya Pradesh, India. *Asian Journal of Chemistry*, 25 (6) : 3109-3112.
10. Thakur Risikesh, Bisen NK, Shrivastava AK, Rai SK and Sarvade S. 2023a. Effect of integrated nutrient management on chickpea productivity and soil fertility status under rice – chickpea cropping system at farmers field of Balaghat District of Madhya Pradesh, India. *Journal of Experimental Agriculture International*. 45(12): 250-256.
11. Thakur Risikesh, Shrivastava AK, Sarvade S, Rai SK, Koutu GK, Bisen NK and Khan MI. 2021. Response of integrated application of inorganic fertilizers and vermicompost on rice productivity at farmer field. *International Journal of Plant and Soil Science*. 33(4): 25–31.

12. Thakur Risikesh, Bisen NK, Shrivastava A, Rai SK, Sarvade S. 2023b. Impact of integrated nutrient management on crop productivity and soil fertility under rice (*Oryza sativa*)–chickpea (*Cicer arietinum*) cropping system in Chhattisgarh plain agro-climatic zone. *Indian Journal of Agronomy*. 68 (1): 9-13.
13. Khan MI, Bisen U, Sarvade S, Gautam K, Bisen S, Rai SK and Shrivastava A. 2021. Study on adoption of chinnor rice production technology and constraints faced by farmers of Balaghat District, Madhya Pradesh. *International Journal of Bio-resource and Stress Management* 12(5): 516-522.
14. Rai SK, Uttam Bisen, Gaur VS, Sarvade S, Solanki RS, Shrivastava AK, Thakur RK, Mohammad Imran Khan and Bisen NK. 2022. A study on growers of underutilized pulse crop Chani (*Cicer arietinum* L.) of Balaghat district, M.P., India. *Ecology Environment and Conservation*, 28 (4): 1851-1856.
15. Shrivastava AK, Thakur RK, Bisen NK, Rai SK and Sarvade S. 2023. Response of integrated nutrient management on crop productivity and soil fertility under rice–wheat cropping system in Chhattisgarh Plain agro-climatic zone. *Journal of Experimental Agriculture International*, 45(12): 201-208.
16. Samui SK, Mitra SD, Roy KA, Mandal K and Saha D. 2000. Evolution of front line demonstration on groundnut. *J. Indian Society Coastal Agric. Res.*, 18 (2): 180-183.
17. Henderson CF and Tilton EW. 1955. Tests with acaricides against brown wheat mite. *Journal of Economic Entomology*, 48: 157-161.
18. Gomez KA and Gomez AA. 1984. Statistical Procedures for Agricultural Research. 2<sup>nd</sup> Edition, John Wiley and Sons, New York, 680 p.
19. Thakur RK, Kauraw DL and Singh Muneshwar (2009). Effect of continuous applications of nutrient inputs on spatial changes of soil physicochemical properties of a medium black soil. *Journal of Soils and Crops*. 19(1): 14-20.
20. Kumar Pawan and Arpandee Kaur Boparai. 2020. Impact of summer moong through improved technology in Jalandhar district of Punjab, India. *Int. J. Curr. Microbiol. App. Sci.* 9(5): 3495-3501.
21. Thakur Risikesh, Sawarkar S.D., Kauraw D.L. and Singh Muneshwar (2010). Effect of Inorganic and Organic Sources on Nutrients Availability in a Verisol. *Agropedology*, 20 (1): 53-59.

22. Sarvade S, Shrivastava AK, Rai SK, Bisen S, Bisen U, Bisen NK, Khan MI. 2020. Socio-economic study of farming communities, their knowledge on climate change and agroforestry systems in the cluster of villages of Chhattisgarh plain region, Madhya Pradesh. *J Pharm Phytochem.* 9(1):2158–2166.
23. Tiwari, R.; Dwivedi, B.S.; Sharma, Y.M.; Thakur, R.; Sharma, A.; Nagwanshi, A. (2023). Soil Properties and Soybean Yield as Influenced by Long Term Fertilizer and Organic Manure Application in a Vertisol under Soybean-Wheat Cropping Sequence. *Legume Research.* DOI: 10.18805/LR-5111.
24. Kushwaha, S.; Sawarkar, S.D.; Thakur, R.; Khamparia, N.K.; Singh, M. (2017). Impact of Long-Term Nutrient Management on Soil N dynamics under Soybean – Wheat Cropping Sequence on a Vertisol. *Journal of the Indian Society of Soil Science*, 65, 274-282.
25. Pathariya, Priyanka, Dwivedi, B.S, Dwivedi, A.K., Thakur, R.K., Singh Muneshwar and Sarvade, S. (2022) Potassium Balance under Soybean–wheat Cropping System in a 44 Year Old Long Term Fertilizer Experiment on a Vertisol, *Communications in Soil Science and Plant Analysis*, 53(2): 214-226.
26. Khandagle, A.; Dwivedi, B.S.; Dwivedi, A.K.; Panwar, S.; Thakur, R.K. (2020). Nitrogen fractions under long-term fertilizer and manure applications in soybean – wheat rotation in a Vertisol. *Journal of the Indian Society of Soil Science*, 68, 186-193.
27. Thakur Risikesh, S. Sarvade and B.S. Dwivedi (2022). Heavy Metals: Soil Contamination and Its Remediation. *AATCC Review*, 10(02): 59-76.
28. Khamparia N.K., Thakur Risikesh and Sawarkar S.D. (2018). Effect of Continuous Use of Inorganic Fertilizers and Organic Manure on Crop Productivity, Soil Fertility and Sustainability of Soybean-Wheat Cropping System in a Vertisol. *Journal of Soils and Crops*, 28(1) : 19-25.