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Summer mung: A pathway to sustainable intensification in Sawai Madhopur, Rajasthan

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In many parts of Rajasthan, Haryana, western Uttar Pradesh, and Madhya Pradesh, monocropping of pearl millet or mustard remains a dominant practice, particularly under limited water availability. Districts like Alwar, Dholpur, and Karauli account for a large share of pearl millet cultivation, while Sawai Madhopur shows a moderate share due to its sandy loam soils, moderate rainfall, and presence of oilseeds, pulses, and spices in the cropping system. Rajasthan ranks first in India for oilseed cultivation, with Sawai Madhopur recording the highest proportion among all districts. Similarly, the state contributes the largest share to national production of both pearl millet and mustard. However, prolonged monocropping has reduced soil fertility, resource use efficiency, and system resilience, highlighting the urgent need for diversification. Interventions such as introducing summer mungbean through cluster frontline demonstrations have shown promising results. Improved varieties like IPM 2-14, IPM 205-7, and MH-1142 not only enhanced productivity but also facilitated significant horizontal spread across Sawai Madhopur district. These outcomes emphasize that integrating short-duration legumes into traditional systems can improve soil health, boost farm income, and enhance sustainability of Indian farming under changing climatic conditions.

Keywords: CFLD, Productivity, Summer mung, Soil health

IN India, many parts of Rajasthan, Haryana, western Uttar Pradesh and Madhya Pradesh covers monocropping system of either pear lmillet or mustard. In recent years, development of short duration and drought resistant variety made this system more pronounced under low water availability conditions. Alwar, Dholpur and Karauli districts of estern Rajasthan covers areas of high percent share of bajra cultivation (>20%). Sawai Madhopur covers 5–20% area of moderate percent share of bajra cultivation. This is due to moderate rainfall, sandy loam soils with moderately developed irrigation facilities, presence of Aravalli's and pre dominance of oilseeds, pulses and spices, etc. In case of Bharatpur district, farmers prefer to cultivate more area under oilseed and pulses due to favourable geo-climatic conditions.

Oilseeds cover 19.53 percent of total cropped area and first ranks in the cropping pattern of Rajasthan. In oilseed cultivation, area of high percentage (>20% of area) includes Alwar, Bharatpur, Karauli, Dholpur and Sawai Madhopur with highest percentage of cultivation, 53.66 percent, amongst all districts of Rajasthan was noted. High share of cultivation is due to alluvial soil with mixture of stones and areas falls in eastern Rajasthan plains with Hadoti plateau, moderate to high rainfall and moderate to high irrigation facilities, etc. In this region, farmers prefer to cultivate mustard in low land area and wheat in high land area, that's why in *rabi* season, oilseed and wheat has major area in this belt. Rajasthan has highest area of 3.74 million hectares in bajra cultivation which was 55.74 % to all India pearl millet acerage with highest production of 3.75 million tonnes and 38.98 % of all India production. In terms of mustard, Rajasthan has the highest area which was 41.77% of all India area and production was 5.48 million tonnes which was 46.63% of all India production which was highest amongst all the states (Agriculture Statistics at a Glance 2023). Agricultural intensifications enhance crop productivity but often leads to reduce crop diversity and increased genetic uniformity. These changes are increasingly linked to negative impacts on the environment and biodiversity, along with reduced resilience and adaptability of cropping system to climate change. Monocropping further exacerbates the issue by lowering resource use efficiency. Thus, for enhancing resource use efficiency and regenerating soil health there is need to break monocropping pattern and introduction of diverse crops in system. Therefore, for

Table 1. Impact of integrated crop management practices on yield of summer mung

Year	ICM demo Area (Ha)	No of ICM Demo.	Potential Yield (q/ha)	Average yield (kg/ha)		Impact (% change)	Extension Gap (q/ha)	Technological gap (q/ha)
				FP (q/ha)	FLD (q/ha)			
2020	20	25	11	3.9	5.02	29.02	1.07	5.97
2021	10	20	11	3.68	4.87	39.35	1.18	6.13
2022	10	20	11	4.3	5.96	37.62	1.59	5.03
2023	10	20	12	4.48	5.77	29.22	1.44	4.66
2024	10	20	12	5.0	6.6	32.80	1.59	4.3
Total	60	105						
Average				4.27	5.64	33.60	1.37	5.21

Table 2. Horizontal spread of improved variety of summer mung in district

Year	Area (ha)	Variety	Seed Production (q)	Increase in area of summer mung (ha)
2020	20	IPM 2-14	100.53	20.00
2021	10	IPM 205 -7	48.70	55.13
2022	10	IPM 205 -7, IPM 2-14	52.10	96.47
2023	10	MH-1142	57.77	154.74
2024	10	MH-1142	59.87	193.78


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CFLD on summer mung in 2024

enhancement of system production efficiency and reduction of biotic and abiotic stresses, there is an urgent need to change the crops and cropping pattern. Pearl millet-mustard and pearl millet-wheat are the predominant cropping systems in Sawai Madhopur district. Continuous adoption of these systems over the years has led to a decline in soil fertility, as well as reduced productivity and farm income. To enhance system productivity and profitability, demonstrations on summer mungbean were conducted during the COVID-19 period in irrigated areas where water availability was adequate. These interventions proved highly successful. Moong was the main *kharif* crop in Sawai Madhopur district, but due to excessive and untimely rains, the production from moong crop decreased and in 2019, the area of *kharif* moong in the district remained 195 hectares, which is absolutely negligible.

Centre's efforts

Krishi Vigyan Kendra (KVK) initiated the programme in 2020 with 20 hectares under Cluster Frontline Demonstrations (CFLDs), which resulted in a total seed production of 100.53 quintals. The seeds produced were utilized by farmers in the following season, thereby ensuring sustainability. Encouraged by the results, CFLDs on summer mungbean have been conducted every year since then, covering more than 100 hectares by 2024. Consequently, the area under summer mungbean in the district has expanded horizontally to over 650 hectares. Some technological interventions applied under the Integrated Crop Management (ICM) mode in CFLDs are as follows:

- Improved variety: IPM 205 -7,IPM 2-14, MH-1142
- Seed rate: 20 kg/ha
- Seed treatment: Thiram @3 g/kg seed or Carbendazim @2 g/kg seed
- Weed management: Pre-emergence application of Pendimethalin 30 EC @1L active ingredient per hectare
- Insect pest management: For pod borer and sucking pests, apply Imidacloprid 17.8 SL @220 mL/ ha
- Fertilizer application: 15 kg nitrogen and 40 kg Phosphorus per hectare (to be applied by farmers)

Impact of integrated crop management practices on yield of mungbean

A total of 105 demonstrations were conducted covering 60 ha, with potential yields ranging from 11–12 q/ha. The average yield under farmers' practice was 4.27 q/ha, while ICM demonstration plots recorded a higher yield of 5.64 q/ha, reflecting a mean yield enhancement of 33.60%. The extension gap averaged 1.37 q/ha, indicating the additional yield that farmers could realize by adopting improved practices, whereas the technological gap was 5.21 q/ha, suggesting further scope for bridging the gap between realized and potential yields through refinement of technologies and improved adoption. These findings highlight the effectiveness of ICM practices in enhancing productivity and narrowing yield gaps in summer mungbean cultivation.

Horizontal spread of improved varietics of summermung in district

The introduction of variety IPM 2-14 in 2020 over 20 ha resulted in a seed production of 100.53 q, leading to an expansion of 20 ha in the area under summer mungbean. In 2021, the variety IPM 205-7 was introduced on 10 ha, producing 48.70 q seed and contributing to an additional 55.13 ha expansion. During 2022, both IPM 205-7 and IPM 2–14 were demonstrated on 10 ha with seed production of 52.10 q, further increasing the cropped area by 96.47 ha. Subsequently, the adoption of variety MH-1142 in 2023 and 2024 produced 57.77 q and 59.87 q seed, respectively, which led to a substantial increase in the horizontal spread of summer mungbean to 154.74 ha in 2023 and 193.78 ha in 2024. The results clearly indicated that the availability of quality seed from demonstrations significantly contributed to large-scale horizontal expansion of summer mungbean cultivation in the district.

Farmers' feedback

Cultivation of summer mungbean provides an additional source of income during the summer season, when fields usually remain fallow. The varieties used are characterized by synchronous pod maturity, which facilitates easy harvesting. Farmers reported that its cultivation involves minimal incidence of weeds and diseases, thereby reducing production costs and enhancing profitability. The produce is utilized not only for household consumption as pulse but also distributed widely among farmers as quality seed, ensuring greater accessibility and sustainability.

SUMMARY

Large parts of Rajasthan and adjoining states follow monocropping of pearl millet and mustard, but this practice has led to soil fertility decline, reduced efficiency, and lower resilience of farming systems. Rajasthan holds the highest share of pearl millet and mustard area and production in India, with Sawai Madhopur district contributing significantly to oilseed cultivation. To address challenges of monocropping, diversification trials with summer mungbean were introduced in irrigated areas of district. Cluster Frontline Demonstrations (CFLDs) during 2020–24 showed yield advantages of over 30% under improved management practices. Improved varieties such as IPM 2-14, IPM 205-7, and MH-1142 facilitated rapid horizontal spread, expanding mungbean area to nearly 194 ha by 2024. These results underlined the potential of integrating short-duration pulses to enhance soil health, productivity, and farm profitability, thereby strengthening sustainability of Indian farming systems.

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