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Yield and Economic Analysis of Mothbean under Rainfed Condition of Villupuram District, Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Field demonstrations were conducted on drought tolerant short duration moth bean variety with improved production technologies by Krishi Vigyan Kendra (KVK), Villupuram, Tamil Nadu for increase the productivity and sustainability. A total of 15 field demonstrations were conducted out at farmer's field by introducing short duration drought tolerant moth bean variety TMV 1during *Rabi*2023-24. The farmers are using local variety for their cultivation used as the check variety (farmer's practice) for comparison. An average yield of 1060kgs/ha was recorded from TMV 1 demonstrations which showed 12.67 % increase over the farmers practice (941.12 kg/ha). The farmershave obtained additional revenue of Rs. 14,110 /ha from varietal demonstrations with improved production practices, which may motivate the farmers to adopt TMV 1 variety with the

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improved pulse production technologies. These type field demonstrations on introduction of short drought tolerant variety effectively influenced the attitudes, skills, and knowledge related to improved practices in pulses cultivation, fostering adoption. It also enhances the productivity and farmers income and improves the relationship between farmers and scientists.

Keywords: Moth bean; field demonstrations; economic; gross income; net income.

1. INTRODUCTION

Pulses play a vital role in Indian Agriculture. In India, total production of pulses is 23.95 Mt. (Anonymous, 2018). Pulses are rich source of protein for a majority of the Indian population. Moth bean (*Vigna acontifolia*) is a native crop of hot and dry region of western Rajasthan and is used as a source of food, feed, fodder, green manuring and green pasture. Green pods are delicious source of vegetables (Choudhary Moth bean is largely cultivated in rainfed conditions. The farmer's are obtained low yield, mainly due to not adopting new production techniques. Timely sowing of crops, maintain optimum plant populations, and suitable agronomic practices are the main key factors to determine the crop growth and higher yield under rainfed condition. Moth bean is grown throughout the tropical, sub-tropical and warmer regions of the world between 30ºN and 35ºS latitude. It tolerates heat and drought. It prefers moist climate during the vegetative period and the cool and dry period during the reproductive stage. It was a dew loving plant. The cloudy weather and optimum rainfall during vegetative period are ideal for this crop. Rainfall is the prime source for water resources in rainfed farming. In Tamil Nadu, the farmers are used to cultivate of moth bean under rainfed condition especially during *rabi* season after receiving rainfall without any preparatory tillage and addition of manures. The front line demonstrations (FLDs) are an important method for transferring the latest package of practices in totality to farmers (Bezbaruah and Deka, 2021). Due to improper management practices, imbalanced and indiscriminate use of pesticides farmers getting low yield and income. The present investigation was undertaken to study the level of knowledge of farmers regarding moth bean cultivation, extent of adoption of improved practices and to find out the yield gap in moth bean production technology. Keeping this in view, the present study was undertaken to popularize the new drought tolerant variety (TMV 1) with improved production technologies to the farmers of villupuram district, Tamil Nadu through field demonstrations and assess the difference between demonstrated technologies vis-a-vis practices followed by the local farmers in moth bean crop.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The short duration high yielding drought tolerant moth bean variety TMV 1 was used as the experimental materials in the present study. A total of 15field demonstrations were conducted at farmers holdings in Villupuram District, Tamil Nadu, India (latitude; 11º 46' North; longitude: 79º.46' East; altitude: 4.60 m MSL) during*Rabi* 2023-2024and compared to check variety(farmer's practice) for yield and economics. The soil type of the demonstrated area was sandy loam with pH 7.0- 7.5 and low-medium in fertility status and medium in organic carbon content. The soil in available P_2O_5 and K_2O was medium. The climatic conditions of the research locations are tropical. Average rainfall of the region is 850-900 mm per annum and relative humidity ranges from 45-85 per cent.

2.2 Experimental Methodology and Crop Monitoring

The moth bean variety (TMV 1) seeds were distributed to selected farmers at no cost basis for one acre along with critical inputs. The critical inputs include post emergency herbicide, bio-fertilizers and water soluble fertilizers. Each demonstration was conducted on an area of 0.4 ha and the same area adjacent to the demonstration plot was kept as farmer's practices. The farmers are advised to raise the crop by line sowing method after seed treatment with bio-fertilizers. The selected farmers were trained for improved production technologies through training programmes funded by NICRA Project, and organized by ICAR, Krishi Vigyan Kendra, Villupuram (TN), during 2023. The package of improved production technologies included short duration drought tolerant variety TMV 1; Seeds were treated with Rhizobium @ 10 g/kg of seeds and inoculated with Phosphate Solubilizing Bacteria @ 10 g/kg of seeds. Sowing was done in December second fortnight with a

seed rate of 20 kg/ha in line sowing with row to row spacing of 30 cm and 10 cm between plants. Optimum plant population was maintained in the all demonstrations. Post emergency herbicide of Imazathapyr @ 250 ml /acre at 15-20 day after sowing was used and followed by one hand weeding was done at 35 day after sowing for control of weeds. Need based plant protection chemicals *viz*., Imidaclopride17.8 SL @ 250ml/ha, Emmamectin Benzoate (5%SG) @ 250g/ha and hexaconazole (5%SC) @ 500 ml/ha were used for integrated pest and disease management. The crop was harvested during March month after the leaves turn yellow and start dropping.

2.3 Data Collection and Analysis

All the demonstration plots ware monitored frequently by KVK Scientists. The observations were recorded on number of pod per plant and grain yield per hectare (kgs). For data collection, ten to fifteen representative plants were selected randomly in each demonstration plots in all the farmers' fields of TMV 1 as well as check plots (Farmer's practice). All the collected data were statistically analyzed by statistical method described by Pansi and Suckatme (Panse and Sukhatme, 1978). The benefit cost ratio was calculated based on gross return and cost of cultivation. The yield data were collected fromboth the demonstration and farmers' practice plots and their economics were worked out (Samui et al., 2000). The gross return was estimated from the sale of the crop output i.e. main produce only at market price. The net return or net income was computed at different cost incurred for different field operations (cost of cultivation) by deducting the respective gross return. The cost benefit ratio (input-output ratio) represents returns obtained per rupee of investment. The input output ratio was worked out based on standard cost concepts i.e. by dividing the gross income by respective cost.

3. RESULTS AND DISCUSSION

The results of all the demonstrations and check plots (farmers practice) were presented in Table 1. The key differences were observed between demonstration package and farmer's practices. In the demonstrated plot only recommended variety, bio-agents and TNAU pulse wonder (foliar nutrients) were used which were given to farmer by the KVK and all the other package and practices were timely performed by the farmers itself under the direction of KVK Scientist. Under farmer's practice, they used own seeds of local moth bean variety for sowing without bio-inoculants seed treatment. The performance of short duration moth bean variety TMV 1 with comparison to the farmers cultivating variety (local) as farmers practice (checks) was monitored periodically by KVK, Scientists, Villupuram.The data on number of pods per plant revealed that, it was ranged from 24.25 to 41.35.The average of number of pods per plant in TMV 1 demonstrations was 31.22 and the check variety (farmers practice) was recorded in 27.55. The pod bearing potential of the variety directly contributes to seed yield. These findings were in the conformity of the results of study carried out by (Meena and Dudi, 2018). Number of pods on moth bean was already reported by (Sipai et al., 2022, Rani et al., 2023) and in Blackgram was reported by (Dwivedi et al., 2018, Jadhao et al., 2022).

3.1 Seed Yield

Results indicated that average yield 1060.10 kg/ha were found in demonstration plot of variety TMV 1 as compared to 940.12 kg/ha in local check plots in the same block. With regard to grain yield in TMV 1 moth bean demonstration fields, the maximum grain yield 1210 kg/ha was observed and minimum yield was 920 kg/ha. The average yield of all demonstration was 1060 kg/ha recorded in TMV 1 demonstrations and for farmers practice, the yield was 940.12 kg/ha. It was 12.65 % increase over the farmers practice (check plots). The improvement in yield might be due to short duration drought tolerant moth bean variety and seed treatment, use of bio fertilizers, timely sowing, foliar application of TNAU pulse wonder, proper and timely weed management and integrated pest and disease management practices. These outcomes are somewhat comparable to (Rachhoya, 2020). The yield improvement in moth bean through front line demonstrations has reported by (Shayam et al.,2018, Priyaranjan et al., 2023, Amuthaselvi et al.,2023). in blackgram was reported by (Amuthaselvi et al., 2023); in chick pea by (Hashim et al., 2024) and in cow pea (Begam et al.,2023) has reported in their research papers.

The economic analysis of field demonstrations and farmers practices was presented Table 2. The average cost of cultivation for the demonstrations was Rs. 42,500/ ha. and gross income was Rs. 90,100/ha. The cost of

cultivation for the farmers practice was Rs. 46,500/ ha and gross income was Rs. 79,900/ha. The farmers getting additional revenue of Rs.14,100/ ha. by cultivating the short duration drought tolerant high yielding moth bean variety TMV 1 with improved production technologies (demonstrations).These findings are aligned with those of (Shayam et al., 2018). The higher net income (Rs. 47,600) was higher when compared to the farmers practice (Rs. 33,490/ha). It was mainly due to introduction of drought tolerant high yielding variety along with improved production technologies and timely supply of critical inputs by ICAR, KVK, Villupuram. Similar kind of front line demonstrations in moth bean was already reported by (Meena and Dheeraj, 2016) The TMV 1 moth bean variety produced higher yield over the check variety in all the demonstrations, clearly indicated that showing constant performance in different locations and TMV 1 was easily adopted to new environments and having high stability over the locations in Villupuram district of Tamil Nadu. Any new variety giving stable performance rainfed condition was good shine for Indian farming. The frontline demonstration program effectively influenced the attitudes, skills, and knowledge related to improved or recommended practices in pulse cultivation, fostering adoption (Ganapathy et al.,2024). It also enhanced the relationship between farmers and scientists, fostering mutual confidence (Ganapathy et al.,2024). During the demonstrations, the farmers emerged as primary sources of information on improved pulse cultivation practices and served as new suppliers

Table 1. Performance of moth bean (TMV 1) demonstrations under rainfed condition

S. No	Farmers Name & Address	No. of pods / Plant		Seed yield		
		TKM 15	Control	Yield (kg/ha)	Control	% Increase
1.	Murugan, M Dhaniyal Village	35.65	31.27	1050	960	11.98
2.	Manivannan, V Naduvanandhal village	24.50	21.15	950	875	8.57
3.	Vijayan, G Naduvanandhal village	26.33	21.63	970	910	12.09
4.	Kesavan, M Naduvanandhal village	31.45	27.46	1010	950	13.68
5.	Kalaiyarasi, P Naduvanandhal village	27.25	24.52	980	870	12.64
6.	Manimekalai, R Dhaniyal Village	25.75	23.75	940	950	15.79
7.	Govindan, M, Naduvanandhal village	24.25	20.82	920	860	8.14
8.	Ramesh, M Naduvanandhal village	30.15	28.65	1030	970	10.31
9.	Muralitharan, R Puliyanur village	27.45	24.82	975	915	6.56
10.	Kalpana, R Puliyanur village	28.25	24.75	1020	910	7.69
11.	Rajaram, M Puliyanur village	37.55	34.65	1125	950	21.58
12.	Murali, R Puliyanur village	34.32	28.15	1050	960	9.38
13.	Valarmathi, M Puliyanur village	35.73	28.35	1120	1010	15.84
14.	Krishnan, M Puliyanur village	41.35	38.25	1210	1070	16.82
15.	Narayanan, V Puliyanur village	35.71	30.45	1075	950	13.16
	Average	**31.22**	**27.55**	**1060.10**	**940.12**	**12.67**
	CD (0.05%)	**4.75**	**4.56**	**175.34**	**178.30**	**-**
	CV (%)	**6.72**	**6.81**	**7.86**	**8.01**	**-**

Table 2. Yield and Economics comparison of demonstrations and farmer's practice

Demonstrations &Farmers practice	Seed Yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio	Additional Income (Rs.)
Improved Variety- (TMV 1+ Improved Production Technologies)	1060.10	42,500	90,100	47,600	2.12	14,110
Farmer's Practice (Check/ Control)	940.85.	46,500	79,900	33,490	1.72	-

of high-quality pure seeds in their locality and neighbouring areas for subsequent crops. The short duration moth bean variety along with improved production technologies demonstrated, contributed to an average increase in seed yield of 12.65% compared to the existing farmers practices. The cost of this yield increment was a nominal of Rs. 14,110 per hectare; an amount was affordable even by small and marginal farmers in rainfed cultivation of moth bean.

4. CONCLUSION

In pulse cultivation, at present getting higher yield and high return was the challenging task to farmers. In this situation, demonstration pertaining to popularization of short duration drought tolerant varieties like TMV 1, along with suitable improved production technological interventions can be an important step in this direction. This drought tolerant variety TMV 1 with its excellent performance in the demonstrations at Villupuram district will play a significant role in improving the productivity, profitability and sustainability in rainfed cultivation.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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