**The Impact of Front-Line Demonstrations on Taramira (*Eruca sativa*)**

**Abstract**

Organization of front-line demonstration is most effective tool for transfer of cost effective technologies among the farmers. Taramira (*Eruca sativa*), a drought-tolerant winter oilseed crop, is primarily grown in the arid and semi-arid regions of north-western India. Despite its suitability to rainfed conditions, traditional practices and local varieties result in low productivity. The primary aim is to showcase the effectiveness of modern farming technologies, identify limitations in production, and evaluate how improved techniques perform across different agricultural settings. To address this, twenty Front Line Demonstrations (FLDs) were conducted during the *rabi* season of 2018–19 by the AICRP on Oilseeds (Taramira Unit), SKNAU, Jobner. A total of 20 demonstrations were conducted using two varieties RTM-1355 and RTM-1351, compared with local farmer practices. The demonstration technologies included timely sowing, line sowing, seed treatment, recommended dose of fertilizers and plant protection measures. The yield data were collected from both the demonstration and farmers practice plots and expressed in terms of per cent increase in yield. Field days and group meetings were organized to give other farmers the chance to observe the advantages of the demonstrated technologies. Results showed a yield increase of 17.68% to 28.84% under improved practices, with yields ranging from 1085 to 1230 kg/ha compared to 875 to 1024 kg/ha under farmers' practices. Economic analysis revealed higher gross, net returns and benefit-cost ratio (3.54 to 4.29) with improved technologies. The results indicate that the adoption of improved taramira varieties RTM-1355 and RTM-1351, coupled with a full package of recommended practices, not only enhances grain yield but also significantly increases the profitability for farmers cultivating under rainfed conditions. The study shows that scientific interventions using FLDs can significantly enhance the yield and profitability of taramira under rainfed conditions, helping bridge the gap between improved technology and traditional practices.

**Keywords:** FLD, Profitability, Rainfed, Taramira, Yield

**Introduction**

Pulses are an important commodity group of crops that provide high quality proteins complementing cereal proteins for vegetarian population of the country. One of the ventures carried out by GOI is conducting frontline demonstrations of pulse crops at the farmers’ fields with an objective to promote the improved crop production technologies under different farming situations and at different agro-climatic regions. Improved technology can be an improved variety, improved nutrient management, improved plant protection technique etc. that helps improvise monetary benefits of the farmers without harming the ecology of the locality (Sharma & Singh, 2024; Lakshi et al., 2024). Taramira, also known as *rocket salad*, is a drought-tolerant, *rabi* season oilseed crop, primarily grown in the drier regions of north-western India. It belongs to the Brassicaceae family and is characterized by its pungent oil, which is not typically consumed directly but is often used to increase the pungency of mustard oil. In India, the main states cultivating taramira are Rajasthan, Haryana, Punjab, Madhya Pradesh, and Uttar Pradesh. Of these, Rajasthan leads the country in both the area under cultivation and taramira production. This crop is well-suited for regions with little to no irrigation, as its deep and efficient root system allows it to access moisture from deeper layers of the soil. In times of severe drought, especially when late Rabi rains occur, taramira often remains the only viable crop option for areas with limited soil moisture. Rajasthan is the top producer of taramira, accounting for over 65% of the cultivation area and contributing 60% of the total national production. However, the use of locally accessible varieties, a lack of diverse kinds and an inadequate package of methods are the main causes of taramira's low productivity in Rajasthan.

Organization of front-line demonstration is most effective tool for transfer of cost-effective technologies among the farmers (Srinivas *et al.,* 2015 and Jeendar *et al.*, 2006). The (FLD) program represents a practical approach to agricultural research, conducted under the direct guidance of agricultural scientists. It involves implementing the improved and recommended crop varieties, along with a complete package of practices, on selected farmers' fields. The technologies developed at the agricultural universities and research stations through research activities are demonstrated in farmer’s field through FLDs. This is one of the most powerful tools of extension because farmers in general are driven by the perception that ‘seeing is believing’. The main objective of FLDs is to demonstrate newly released crop production and protection technologies and its management practices at the farmer’s field under different agro-climatic regions and farming situations (Praveenakumar et al., 2024). The primary aim is to showcase the effectiveness of modern farming technologies, identify limitations in production, and evaluate how improved techniques perform across different agricultural settings. By bridging the gap between existing traditional methods and scientifically recommended practices, this initiative helps boost crop productivity and farmer incomes. The primary objective of Front Line Demonstrations (FLDs) is to showcase newly released crop production and protection technologies, along with their management practices, directly in farmers’ fields across diverse agro-climatic zones and farming conditions. These demonstrations aim to provide practical, on-ground evidence of the effectiveness of improved technologies. While implementing these technologies, scientists closely study the factors contributing to increased crop productivity, as well as the challenges and constraints faced by farmers in adopting the new mustard production techniques. This approach helps identify gaps and facilitates the refinement of technologies to better suit local farming conditions and enhance adoption rates. Additionally, it supports crop diversification and fosters self-sufficiency within the current socio-economic and agro-ecological framework based on insights from Choudhary *et al.* (2009).

Considering these aspects, the present study was conducted to showcase and disseminate improved technologies for taramira cultivation through Front Line Demonstrations (FLDs) under rainfed conditions. The primary objectives were to increase crop productivity and profitability while reducing the gap between research-based and actual farm yields.

**Materials and Methods**

The study was conducted by the AICRP on Oilseeds (Taramira Unit), SKNAU, Jobner, during the *rabi* season of year 2018–19, involving a total of 20 FLDs (full package). The varieties demonstrated during the FLDs were RTM-1351 and RTM-1355, both recommended for better yield and adaptability in rainfed conditions. The demonstrations were carried out across eleven villages, namely: *Kanadvas, Unbada Gaon, Haripura, Mandvi, Mateda, Harnathpura, Bordi Vali Kothi, Chhitroli, Beniyon ka Bas, Dabla*, and *Jarna*. These villages are located in three different districts: Jaipur, Sikar, and Dausa, covering an area of the region where taramira is an important crop under marginal conditions. The selection of farmers and locations was done in collaboration with local extension functionaries and village leaders to ensure relevance and accessibility. All technical inputs and advisory services were provided as per the recommendations. The demonstrated improved technology for taramira included timely sowing, line sowing, use of improved varieties, seed treatment, recommended fertilizer application with proper placement, effective plant protection, and timely weeding and hoeing. In contrast, farmers commonly practiced very late sowing, broadcast seeding, used local seeds without treatment, rarely applied fertilizers or followed placement methods, neglected plant protection measures, and did not perform timely weeding or hoeing. These differences highlight how adopting improved practices can significantly enhance crop growth, yield, and profitability compared to traditional methods.

The prevalent cropping systems of demonstration areas were pearlmillet–mustard, cluster bean–mustard, sorghum–mustard, pearlmillet/sorghum–taramira, and green gram/urd–mustard rotations. The sowing of taramira was done between October 20 and October 30, 2018, and harvesting took place from March 10 to March 19, 2019. Improved taramira varieties RTM-1351 and RTM-1355 were sown using conserved soil moisture conditions. During the crop growth period, pest and disease incidences were monitored. Moderate attacks of painted bugs were observed during early growth stages, and aphid infestations occurred during the pod development stage. Additionally, slight frost injury was noted towards the final stages of the crop. Feedback from participating farmers indicated full satisfaction with the performance of the improved varieties and associated technology under rainfed conditions. Monitoring and evaluation of the demonstrations were conducted by the All India Coordinated Research Project (AICRP) monitoring team in February 2019, along with officials from the State Department of Agriculture, Rajasthan. The FLDs were also visited by farmer delegations from various states, including Rajasthan, Punjab, Haryana, Gujarat, as well as representatives from NGOs.

Scientists involved in the demonstrations expressed full satisfaction with the crop performance, particularly under conserved soil moisture conditions, affirming the suitability of the improved technology package for rainfed taramira cultivation. The farmers were guided by scientists in every stage of the crop, with respect to optimum plant population, recommended dose of fertilizer, irrigation management and plant protection measures. The yield data were collected from both the demonstration and farmers' practice plots and expressed in terms of per cent increase in yield. Field days and group meetings were organized to give other farmers the chance to observe the advantages of the demonstrated technologies. Data were collected from both the FLD (Front Line Demonstration) plots and control plots, and calculations were made for the cost of cultivation, net income, and benefit-cost ratio (Samui *et al.,* 2000).

 **Table 1. Details of the demonstrated improved technology and farmer’s practice**

|  |  |
| --- | --- |
| **Components of demonstrated technology** | **Prevailing farmer’s practices against demonstrated technology** |
| 1. Timely sowing
2. Line sowing
3. Use of improved variety
4. Seed treatment
5. Application of recommended dose of fertilizer and proper fertilizer placement methods
6. Adoption of proper plant protection measures
7. Timely weeding and hoeing
 | 1. Very late sowing
2. Broad cast method of sowing
3. Use of local seed
4. No seed treatment
5. No application of fertilizer and unawareness of fertilizer placement methods
6. Plant protection measures usually not adopted
7. No weeding and hoeing
 |

**Results and Discussion**

A total of 20 Front Line Demonstrations (FLDs) were conducted on taramira during the *Rabi* season of 2018–19 under rainfed conditions, focusing on the performance of improved varieties RTM-1355 and RTM-1351. These demonstrations aimed to assess the effectiveness of the improved package of practices (IP) in comparison to the traditional farmer practices (FP) that typically involve local varieties. The results clearly demonstrated a substantial increase in yield with the adoption of the improved varieties. The mean yield recorded under IP ranged from 1085 to 1230 kg per hectare, whereas the yield under FP, which utilized local varieties and conventional practices, was significantly lower, ranging between 875 and 1024 kg per hectare. This corresponds to a percentage increase in yield over farmers’ practices (YIOFP) ranging from 17.68% to 28.84%, reflecting the superior agronomic performance and adaptability of the improved varieties under the given environmental and management conditions. The findings of this study are consistent with those reported by Meena *et al.* (2019), who also observed significant yield improvements in taramira cultivation following the adoption of improved varieties and recommended agronomic practices under rainfed conditions. [Singh *et al*., (2014)](https://arccjournals.com/journal/agricultural-reviews/R-2694#singh_2014) also suggested that the use of high-yielding improved varieties under FLD programmes leads to an increase in production as well as productivity also. Kumar *et al.* (2019) also reported higher mustard yields under demonstration plots compared to traditional farmer practices during their study period, clearly highlighting the beneficial impact of FLDs in improving crop productivity over existing methods. This consistency reinforces the reliability of the demonstrated technologies and highlights the potential for wider dissemination and adoption among farmers, especially in moisture-limited and drought-prone areas where taramira is an important oilseed crop.

The cost of cultivation (COC) under improved practices (IP) during the frontline demonstrations varied from Rs. 8990 to Rs. 9625 per hectare. This cost was slightly higher compared to farmers’ practices (FP), where the cost ranged from Rs. 7600 to Rs. 8430 per hectare. The increase in expenditure under IP is primarily attributed to the use of improved inputs such as high-quality seeds of taramira varieties RTM-1355 and RTM-1351, enhanced nutrient management, and better crop protection measures. Although the initial investment was higher, the adoption of these inputs and recommended agronomic techniques contributed significantly to improving crop performance. In terms of economic returns, the gross monetary return (GMR) under IP was substantially greater, ranging from Rs. 43,400 to Rs. 49,200 per hectare, while the returns under FP were comparatively lower, between Rs. 35,000 and Rs. 40,960 per hectare. This marked increase in GMR demonstrates the positive impact of improved cultivation methods on overall productivity and marketable yield. The additional net monetary return (ANMR), which reflects the extra profit earned after deducting the cost of cultivation, was observed to be between Rs. 5225 and Rs. 9465 per hectare. These figures indicate that despite the slightly higher cultivation costs, the economic benefits from adopting improved practices far outweigh the additional investment. These results are also in conformity with the findings of Kumar and Jakhar (2022).

The benefit-cost (B:C) ratio, a key indicator of profitability, also showed notable improvement under IP, ranging from 3.54 to 4.29, compared to 3.27 to 3.98 observed under traditional FP. A higher B:C ratio signifies better economic efficiency and a more sustainable cropping system. These results align well with the findings of Sangwan *et al.* (2021), who reported similar trends in increased profitability and efficiency in taramira cultivation when improved practices were adopted. The results are also in close conformity with the findings of Jat *et al*. (2021). Moreover, the superior performance of the recommended package of practices (PoP) under rainfed conditions has been well documented in earlier studies by Mitra and Samajdar (2010) and Balai *et al.* (2012), which also highlighted the advantages of frontline demonstrations in promoting modern agricultural techniques among farmers. The consistency of these findings reinforces the reliability and effectiveness of the improved taramira cultivation package.

Overall, the data indicate that the adoption of improved taramira varieties RTM-1355 and RTM-1351, coupled with a full package of recommended practices, not only enhances grain yield but also significantly increases the profitability for farmers cultivating under rainfed conditions. This suggests that scaling up such improved technologies can play a crucial role in enhancing crop productivity and income generation in drought-prone and moisture-limited areas, thereby contributing to sustainable agricultural development and improved livelihoods.

**Conclusion**

The primary objective of Front-Line Demonstrations is to showcase newly released crop production and protection technologies, along with their management practices, directly in farmers’ fields across diverse agro-climatic zones and farming conditions. From the findings of the present study, it may be concluded that the use of improved varieties and production technology of taramira can reduce the yield gap to a considerable extent, resulting in increased productivity and profitability of taramira in the rainfed regions of Rajasthan.

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**Table 2: Details of FLDs conducted on taramira during 2018-19**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SN** | **Varieties used in IP** | **Situation****Irrigated/ Rainfed** | **Varieties used in FP** | **Mean yield (kg /ha)** | **YIOFP****(%)** | **COC (Rs/ha)** | **GMR (Rs/ha)** | **ANMR****(Rs/ha)** | **B: C Ratio** |
| **IP** | **FP** | **IP** | **FP** | **IP** | **FP** | **IP** | **FP** |
| **1** | RTM- 1355 | Rainfed | Local | 1087 | 923 | 17.77 | 9345 | 8010 | 43480 | 36920 | 5225 | 3.65 | 3.61 |
| **2** | -do- | Rainfed | -do- | 1135 | 945 | 20.11 | 9200 | 8150 | 45400 | 37800 | 6550 | 3.93 | 3.64 |
| **3** | -do- | Rainfed | -do- | 1105 | 895 | 23.46 | 9030 | 8070 | 44200 | 35800 | 7440 | 3.89 | 3.44 |
| **4** | -do- | Rainfed | -do- | 1200 | 1005 | 19.40 | 9250 | 8065 | 48000 | 40200 | 6615 | 4.19 | 3.98 |
| **5** | -do- | Rainfed | -do- | 1085 | 875 | 24.00 | 9560 | 8200 | 43400 | 35000 | 7040 | 3.54 | 3.27 |
| **6** | -do- | Rainfed | -do- | 1224 | 950 | 28.84 | 9495 | 8000 | 48960 | 38000 | 9465 | 4.16 | 3.75 |
| **7** | -do- | Rainfed | -do- | 1160 | 975 | 18.97 | 9200 | 7960 | 46400 | 39000 | 6160 | 4.04 | 3.90 |
| **8** | -do- | Rainfed | -do- | 1188 | 924 | 28.57 | 8990 | 7600 | 47520 | 36960 | 9170 | 4.29 | 3.86 |
| **9** | -do- | Rainfed | -do- | 1210 | 1000 | 21.00 | 9550 | 8195 | 48400 | 40000 | 7045 | 4.07 | 3.88 |
| **10** | RTM- 1351 | Rainfed | -do- | 1095 | 875 | 25.14 | 9420 | 8005 | 43800 | 35000 | 7385 | 3.65 | 3.37 |
| **11** | -do- | Rainfed | -do- | 1186 | 985 | 20.41 | 9485 | 8167 | 47200 | 39400 | 6722 | 4.00 | 3.82 |
| **12** | -do- | Rainfed | -do- | 1200 | 990 | 21.21 | 9430 | 8200 | 48000 | 39600 | 7170 | 4.09 | 3.83 |
| **13** | -do- | Rainfed | -do- | 1146 | 933 | 22.83 | 9345 | 8010 | 45840 | 37320 | 7185 | 3.91 | 3.66 |
| **14** | -do- | Rainfed | -do- | 1175 | 980 | 19.90 | 9550 | 8355 | 47000 | 39200 | 6605 | 3.92 | 3.69 |
| **15** | -do- | Rainfed | -do- | 1230 | 965 | 27.46 | 9625 | 8300 | 49200 | 38600 | 9275 | 4.11 | 3.65 |
| **16** | -do- | Rainfed | -do- | 1205 | 1024 | 17.68 | 9615 | 8430 | 48200 | 40960 | 6055 | 4.01 | 3.86 |
| **17** | -do- | Rainfed | -do- | 1190 | 975 | 22.05 | 9545 | 8360 | 47600 | 39000 | 7415 | 3.99 | 3.67 |
| **18** | -do- | Rainfed | -do- | 1140 | 935 | 21.93 | 9621 | 8220 | 45600 | 37400 | 6799 | 3.74 | 3.55 |
| **19** | -do- | Rainfed | -do- | 1220 | 955 | 27.75 | 9510 | 8270 | 48800 | 38200 | 9360 | 4.13 | 3.62 |
| **20** | -do- | Rainfed | -do- | 1095 | 875 | 25.14 | 9325 | 8015 | 43800 | 35000 | 7490 | 3.70 | 3.37 |

*Abbreviations used IR: Irrigated; RF: Rainfed; YIOFP: Yield increase over farmer’s practice; CoC: Cost of cultivation; GMR: Gross monetary return; ANMR: Additional Net Monetary Return; IP: Improved practices; FP: Farmers’ Practices; B:C : Benefit : Cost;*