**Cluster Front Line Demonstration- A novel extension approach for production improvement of Mustard crop in semi-arid condition of Jaipur District of Rajasthan**

**Abstract** - Cluster front line demonstration (CFLDs) on mustard was conducted by Krishi Vigyan Kendra, Chomu (Tankarda) District- Jaipur (Rajasthan) during *rabi* 2020-21 and 2021-22 respectively, and the demonstration conducted in six villages namely Sevapura, Shrirampura, Tankarda, Adagela, Mendwas and Sirsiya in Jaipur district with total number of demonstrations 275 and an area of 110 ha. The improved technology consists of improved variety, seed treatment, weed management, nutrient management and plant protection measures. The results revealed that maximum average yield was recorded 23.84 q/ha in demonstration plot and minimum yield was recorded 19.06 q/ha in farmers practices. The highest average net return (Rs.91,536/ha) was obtained in the demonstration plot as compared to farmers’ practice (Rs.70,450/ha). The average B:C ratio was 4.83 in demonstrated plot and 4.34 in farmer practices. The average yield increase percent was 25.15 in demonstration plot as compared to farmer practices. The average technology gap 3.66 q/ha, extension gap was 4.78 q/ha and technology index 13.31 percent were obtained.

**K e y w o r d s:** CFLDs, Mustard, Variety, Yield and Benefit cost ratio.

**Introduction:** Indian mustard (*Brassica juncea* L.) is one of the most important winter oilseed crops and India is the third largest rapeseed-mustard producer in the world after China and Canada with 11.12% of world’s total production (DRMR, 2012-13). Rapeseed- Mustard is the second most important oilseed crop in India after soybean and accounts for nearly 20-22% of total oilseeds produced in the country. India rank first in total rapeseed mustard production. The major rapeseed mustard growing states in India are Rajasthan, Madhya Pradesh, Utter Pradesh, Haryana, Punjab, West Bengal, Gujarat, Bihar and Assam. Mustard is one of the most important oilseeds crops, which plays a major role in supplementing the income of small and marginal farmers. One of the major constraints of traditional mustard farming is low productivity due to non-adoption of recommended package of practices and improved varieties.

The aim of the frontline demonstration is to convey the technical message to farmers that if they use recommended package and practices then the yield of this crop can be easily doubled than their present level. The improved technology packages were also found to be financially attractive. Yet, adoption levels for several components of the improved technology were low, emphasizing the need for better dissemination (Kiresur et al., 2001).

 Frontline demonstration (FLD) 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 Front-Line Demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers’ field under different agro-climatic regions and farming situations. Keeping the importance of CFLDs, the KVK Chomu (Jaipur-1) has been conducted CFLDs on mustard with the objective to identify the yield gaps between farmer’s practice and front-line demonstration in the operational area of the KVK.

**Materials and Methods**

 The present investigation of cluster frontline demonstrations (CFLDs) on Mustard was conducted by Krishi Vigyan Kendra, Chomu (Tankarda) Jaipur-1 during *Rabi* 2020-21and 2021-22 at villages namely Sevapura, Shrirampura, Tankarda, Adagela, Mendwas and Sirsiya in Jaipur district of Rajasthan state.The demonstration was conducted in an area of 80 ha with 200 demonstrations in *Rabi* 2020-21and and 30 ha with 75 demonstrations in *Rabi* 2021-22 and with six locations against local variety in two years and each demonstration size was 0.4 ha. Total number of demonstrations 275 with area of 110 ha (*Rabi* 2020-21 to 2021-22) were conducted with active participation of farmers to demonstrate the improved technologies of mustard in different villages, so that to sustain production potentials and expand the area under the crop in the district. Present study with respect to CFLDs and farmers’ practices (FP) are given in Table 1. The soils in selected villages were sandy loam to loamy sand in texture. Farmers were trained to follow the package of practices for mustard cultivation as recommended by III A Zone of Rajasthan and need based critical inputs provided to the farmers for increasing productivity of mustard crop. (Table No. 1).

 **Table No. 1: Technological gap analysis for mustard**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Technology** | **Existing Farmers’ Practices** | **Recommended Practices** |
| 1 | Variety | Bio-902 / local available seed  | Giriraj, RH-749 and RH-725 |
| 2 | Seed rate | 5-6 kg/ha  | 4.0 kg/ha |
| 3 | Seed treatment | No seed treatment | Metalaxyl 35% SD @ 6 gm per kg seed |
| 4 | Bio - fertilizers | No use of PSB culture  | PSB culture @ 5 ml/kg seed |
| 5 | Nutrient management | NPS - 40:20:00 kg/ha | NPS - 60:40:40 kg/ha |
| 6. | Weed management | One Hand Weeding | Weed Management : Pendamethaline @ 750 gm a.i./ha as a pr-emergenceOne hand weeding 30-35 DAS |
| 7 | Plant protection | Methyl Parathion Dust @15 kg/ha for Aphid | Spray of Imidacloprid 17.8 SL @ 0.4 ml per liter of water for aphid management |

 The Assessment of gap in adoption of recommended technology before conducting cluster frontline demonstrations by group meeting and discussion with farmers in villages. The training was organized to selected farmers for conducting cluster frontline demonstrations of mustard crop. Technological intervention like improved technology for mustard production. KVK Scientists visited regular cluster frontline demonstration fields and farmer’s fields sowing to harvesting of crop. The feedback collected from the farmers for further improvement in research. The extension activities like that Scientists visits time to time at CFLDs fields and field days were organized at the good stage of crops.

The technology gap, extension gap and technology index were calculated using the following formulae given by (Samui et al., 2000).

Extension gap = Demonstration yield - Farmers’ practice yield

Technology gap = Potential yield – Demonstration yield

Technology Index = Potential yield - Demonstration yield

 X100

 Potential yield

**Results and Discussion:**

The results of the cluster frontline demonstrations (Table No. 2) conducted at farmers’ field clearly found that yield of mustard was recorded higher under demonstration plots in comparison to the farmer’s practice during both the years (2020-21 to 2021-22). The yield of mustard during two years ranged from 23.38 to 24.30 q/ha under demonstration plots as against 18.41 to 19.71 q/ha under farmers practices (Control plot). The demonstrated technologies obtained mean yield of 23.84 q/ha which represents 25.15 percent yield enhancement over farmers practice (19.06 q/ha). The result is in conformity with the finding of Tiwari & Saxena (2001), Verma et al., (2012), Chaudhary et. al., (2018), Shukla et. al., (2022). The results clearly indicated the higher productivity of mustard under cluster frontline demonstration in comparison to farmer’s practice due to the use of high yielding variety, timely sowing, balance does of fertilizers and inclusion of sulphur in fertilizers application along with recommended doses of nitrogen & phosphorus (NP) fertilizers, improved agronomic practices and need based plant protection measures. So, demonstration technologies had excellent impact on seed yield of mustard as compared to local varieties used by farmers.

**Extension gap:**

The study of (Table No. 2) found that an extension gap of 4.59 to 4.97 q/ha was obtained between demonstrated technology and farmers' practice and average extension gap of 4.78 q/ha in the two years of demonstrations. The highest extension gap was found 4.97 q/ha during *rabi* 2021-22 and the lowest extension gap was found 4.59 q/ha during *rabi* 2020-21.

This gap might be due to adoption of improved scientific technologies in demonstrations which resulted in increased grain yield than the traditional and old farmers’ practices. Greater use of latest production technologies along with more emphasis in the use of high yielding new variety will ultimately narrow this alarming trend of wider extension gap. The latest technologies will gradually lead to the farmers to discontinue the old technology and to adopt new technology. The similar results were also reported by Goswami et al., (1996), Hiremath & Nagaraju (2010), Shukla et. al., (2022).

**Technology gap:**

The technology gap was found 3.20 and 4.12 q/ha during *rabi* 2020-21 and 2021-22 respectively, and average technology gap of two years was recorded 3.66 q/ha. The difference in technology gap in different years was due to better performance of improved varieties along with different type of interventions and suitable of demonstrated technologies during the two years in different locations of Jaipur district. The technology gap observed may be attributing to the dissimilarity in soil fertility status, timely sowing and weather conditions. Similar finding was recorded by Mitra & Samajdar (2010), Chaudhary et. al., (2018).

**Technology Index:** This study observed that the technology index was range from 11.64 to 14.98 percent during *rabi* 2020-21 and 2021-22, respectively. The average technology index was found 13.31 percent in two years of demonstration. The technology index indicated the suitability of the demonstrated technologies at the farmer's fields and the lower the value of technology index more is the feasibility of the technology. The similar results were reported by Jeengar et al., (2016), Mitra & Samajdar (2010), Shukla et. al., (2022).

**Table.2 Seed yield of Mustard crop under cluster frontline demonstrations (CFLD) and farmer practice (FP)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Area (ha.)** | **No. of Demo.** | **Variety** | **Yield (q/ha)** | **Percent increase over farmers practices** | **Extension gap (q/ ha)**  | **Technology gap (q/ ha)** | **Technology index (%)** |
| **Potential** | **Demo.** | **Farmer Practices** |
| 2020-21 | 80 | 200 | Giriraj (DRMRIJ-31 ) | 27.5 | 24.30 | 19.71 | 23.29 | 4.59 | 3.20 | 11.64 |
| 2021-22 | 30 | 75 | Giriraj (DRMRIJ-31 ) | 27.5 | 23.38 | 18.41 | 27.00 | 4.97 | 4.12 | 14.98 |
| **Total** | 110 | 275 | - | - | - | - | - | - | - | - |
| **Average** | - | - | - | 27.5 | 23.84 | 19.06 | 25.15 | 4.78 | 3.66 | 13.31 |

**Demo. – Demonstration, CFLD – Cluster Frontline Demonstration, FP- Farmer Practice**

**Table.3 Economics of mustard crop under CFLD and farmer practice (FP)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Cost of Cultivation (Rs/ha)** | **Gross return (Rs./ha)** | **Net return (Rs./ha)** | **B:C ratio** |
| **Demo.** | **Farmer Practices** | **Demo.** | **Farmer Practices** | **Demo.** | **Farmer Practices** | **Demo.** | **Farmer Practices** |
| 2020-21 | 22493 | 19373 | 112995 | 91652 | 90502 | 72279 | 5.02 | 4.73 |
| 2021-22 | 25500 | 23350 | 118069 | 91971 | 92569 | 68621 | 4.63 | 3.94 |
| **Average** | 23997 | 21362 | 115532 | 91812 | 91536 | 70450 | 4.83 | 4.34 |

**Economics**

The economics of mustard under cluster front line demonstrations were estimated and the results have been presented in Table 3. The results clearly showed that the cluster front line demonstrations recorded higher average gross returns Rs. 112995/ha and Rs. 118069/ha) and net return (Rs. 90502/ha and Rs. 92569/ha) with higher cost: benefit ratio (5.02 and 4.63) respectively, during *rabi* 2020-21 and 2021-22 as compared to farmer’s practice. The maximum mean value of two years of gross returns of Rs. 115532/ha, net return Rs. 91536 and B:C ratio 4.83 was recorded in cluster front line demonstrations as compared to farmer practice.

Economic returns as a function of seed yield and MSP sale price varied during the years. Maximum returns were achieved due to increased seed yield and Minimum Support Prices sale rates as decided by Government of India. The greater additional returns and effective gain obtained under cluster front line demonstrations could only be due to the use of effective proven technologies, non-monetary factors, timely operations of crop cultivation and scientific monitoring being conducted time to time of the farmer's field. The results confirm the findings of frontline demonstrations on oilseed and pulse crops by Verma et al., (2012), Yadav et al., (2004), Shukla et al., (2022), Yadav & Khan (2024).

**Conclusion:**

It is concluded that based on the two years results of cluster front line demonstration on mustard crop the yield increased up to 25.15 percent more as compared to farmer practices, hence the adoption of integrated crop management practices along with improved variety Giriraj performed good than farmer practices in all the demonstrations. Demonstrated technologies were found effective for enhanced the yield and cluster front line demonstration were the most successful tools for transfer of technology for enhancing the productivity of mustard. So that, it is need to disseminate the improved variety with recommended technologies in the farmers field with extension methods such as training, field visits and field day.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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