Research Article

# Study the Yield Gap Analysis of Mustard Crop under Adapted Tribal Villages of Bhilwara District

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**Abstract**

The study was carried out under AICRPDA-TSP in tribal dominant panchyat Shyampura, Mohanpura of Mandalgarh block and Kuradia and Rawatkhera of Jhajpur block of Bhilwara district during 2012-13 to 2014-15. Total 576 front line demonstrations were conducted on mustard in 115.2 hectare by the active participation of the farmers with the objective of improved technologies of mustard production. The improved technologies consist improved mustard varieties (BIO-902, Pusa Bold and Laxmi), application of balanced fertilizers (soil test based) and integrated disease and pest management, etc. The demonstrated recorded an average yield ranging from 1364 kg to 1647 kg/ ha with a mean of 1470 kg/ha. The per cent increase yield in demonstration ranged from 18.02% to 32.66% in the respective years with a mean of 25.01%. The average extension gap, technology gap and technology index were 508.29 kg/ha, 294.14 kg/ha and 27.26 %, respectively. The demonstrated field gave higher additional net return Rs 39373/- to Rs 57653/ ha with mean Rs 47891/ha. Further the demonstrated field gave higher additional net return Rs 7957/- to Rs 15948/ ha with mean Rs 11399/ha and B: C ratio 2.98 to 3.89 and with a mean 3.36, respectively. Present results clearly show that the yield and economics of mustard can be boost up by adoption of recommended technology.

**Keywords:** Mustard production technology, frontline demonstration, Economics and yield

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## Introduction

Indian mustard (*Brassica juncea* L.) is a member of the Brassicaceae family and has become one of the most important sources of oil production in the mustard in India is 5.80 million ha, 6.2 million ton with productivity 1089 kg/ha, respectively during the 2015-16 [1]. In Rajasthan is 2433.70 thousand ha, 2878930 tone with productivity of 1183 kg/ha during 2014-15 [2]. The importance and potential of rapeseed-mustard crop is well known as it is the key oilseed crop that can help in addressing the challenge of demand - supply gap of edible oil in India. It is world's third most important source of edible oil after soybean and oil palm. Each and every part of the plant is of importance in the human livelihood. It is also utilized for flavouring, medicinal and preservative purpose since time immemorial. The brassica oilseeds have the oil content of 30-48% in air dried seeds. Colour of the oil is yellow to brown. Rapeseed and mustard oils have anti nutritional factors like erucic acid. However, varieties are now being developed with reduced erucic acid (<2%). The cultivars with <2% of erucic acid in oil and < 30 micromoles/gram of glucosinolates in oil meal are called as Conola varieties suitable for edible purpose. It is also desirable to have less linolenic acid (<3%) and higher linoleic acid (>30%) for prolonged cooking and higher shelf life. But brassicas destined for industrial purpose should contain higher erucic acid (>60%) as it has high heat stability and used as lubricating oil, fossil fuel and additive to diesel [1]. Frontline Demonstration (FLD) is the new concept of field demonstration evolved by the Indian Council of Agricultural Research with the inception of the technology mission on oilseed crops during mid eighties. The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is called front-line demonstrations because the technologies are demonstrated for the first time by the scientists themselves before being fed into the main extension system of the state department of agriculture. 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 frontline 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. While demonstrating the technologies in the farmers' field, the scientists are required to study the factors contributing higher crop production; field constrains for production and thereby generates production data and feedback information. Frontline Demonstrations are conducted in a block of

two or four hectares land in order to have better impact of the demonstrated technologies on the farmers and field level extension functionaries [3]. The production potential of mustard crop depends on a number of interacting factors such as cultural, sowing time, fertilizers, insects-pests, crop management, pesticides and agronomic condition prevailed at the particular crop season [4].

Bhilwara district falls under sub–humid south eastern plains (IV-a) which covers a geographical area of about 3.36 m ha spread over Bhilwara, Rajsamand and part of Udaipur, Chittorgarh and Sirohi districts. Bhilwara situated at $24^0$ 20' latitude and $74^0$ 40' E longitudes at elevation of 463 m above mean sea level. Two panchayat samiti i.e. Mandalgarh and Jahajpur are dominant in tribal population among the eleven (11) panchayat samiti of Bhilwara district. Tribal population in Mandalgarh panchayat samiti is 33.18% and in Jahajpur panchayat samiti 20.67%. Therefore, to enhance the production and productivity in tribal area both panchayat samiti were selected for under AICRPDA-TSP in Bhilwara district. In the selected villages detail base line survey was conducted to identify the basic needs of target area of tribal farmers. Further, pre seasonal training programme were organized in all three panchayat in Mandalgarh and Jahajpur panchayat samiti of Bhilwara district (**Figure 1**).

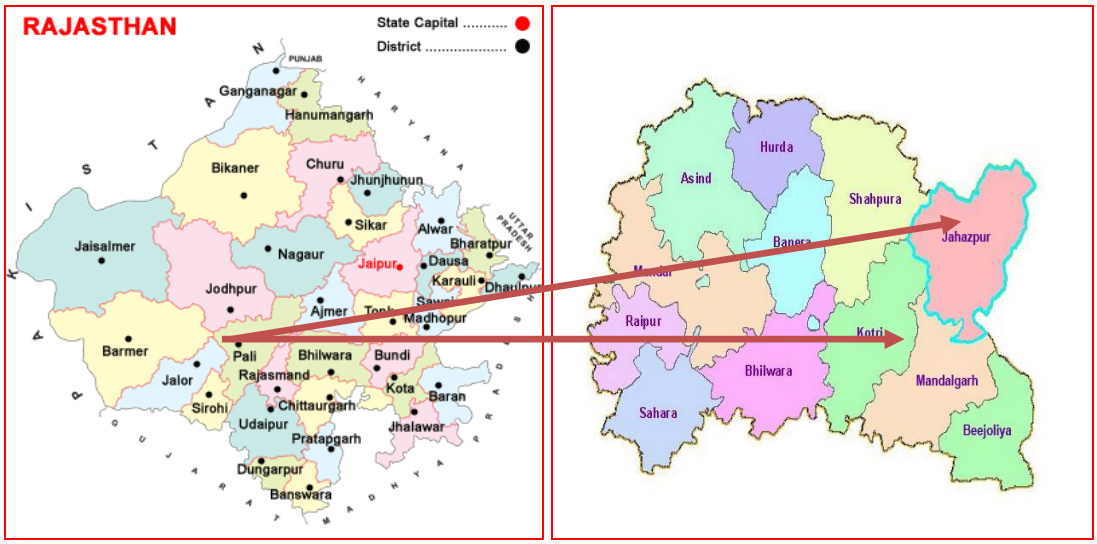



**Figure 1** General view of TSP villages area in Bhilwara district of Rajasthan state

## Material and Methods

The frontline demonstrations were conducted by several institutes or organizations in Rajasthan but due to paucity of time and proximity, study was confined to FLDs conducted by scientists of Dryland Farming Research Station, Arjia, Bhilwara (Rajasthan). Bhilwara district falls under sub–humid south eastern plains (IV-a) which covers a geographical area of about 3.36 m ha spread over Bhilwara, Rajsamand and part of Udaipur, Chittorgarh and Sirohi districts. Bhilwara situated at $24^0$ 20' latitude and $74^0$ 40' E longitudes at elevation of 463 m above mean sea level. Two panchayat samiti i.e. Mandalgarh and Jahajpur are dominant with tribal population among the eleven (11) panchayat samiti of Bhilwara district. Tribal population in Mandalgarh panchayat samiti was 33.18% and in Jahajpur panchayat samiti 20.67%. Therefore, both panchayat samiti were selected for Tribal Sub Plan under AICRPDA in Bhilwara district. In the selected villages detail survey was conducted to identify the basic needs of target area of tribal farmers. Further, pre seasonal training programme were organized in all three panchayat in Mandalgarh and Jahajpur panchayat samiti of Bhilwara district. During 2011-12 to 2014-15, a total 200 front line demonstrations on mustard varieties (BIO-902, Pusa Bold and Varuna) was conducted at farmer's field in the TSP villages of Hence to increase the production and productivity of different crops and cropping systems following activities were taken up during *kharif* and *rabi* season 2012-15.

***Selected Tribal villages in Bhilwara district***

| Tehsil | Panchyat | Villages (27) |
|---|---|---|
| Mandalgarh | Shyampura | Sarsiya, Barapal, Naya Kua, Ghatarani |
| | Mohanpura | Aanando ka khera, Bheru ka Rada, Dolji khera, Himatpura, Magdeh, Gadiya |
| Jhajpur | Rawat kheda | Rawatkhera, Ramgarh, Tarniya khera, Chabdiya, Jalampura |
| | Kuradia | Kuradiya, Mata ji ka Khera, Dhadola, Chhajola ka khera, Bhilo ka Jhupra, |

The yield and economic performance of frontline demonstrations, the data on output were collected from FLDs as well as local plots and finally the grain yield, cost of cultivation, net returns with the benefit cost ratio was worked out. For the purpose of investigation, Chomakot villages of Kota district, where FLDs were conducted during 2011-12 to 2014-15. For selection of beneficiary farmers, a list of farmers where FLDs on mustard were conducted during Rabi 2011-12 to 2014-15 was prepared and taking equal representation. The data were collected through personal contacts with the help of well- structured interview schedule. The gathered data were processed, tabulated, classified and analyzed in terms of mean present score and ranks in the light of objectives of the study. More than 14 percent difference between beneficiary and non-beneficiary farmers' was considered as significant difference. The extension gap, technology gap and technology index were calculated using the formula as suggested by [5, 6]

Extension gap ($qha^{-1}$) = Demonstration yield– Farmer's yield
Technology gap ($qha^{-1}$) = Potential yield– Demonstration yield
Technology index (%) = [Potential yield– Demonstration yield / Potential yield] x 100

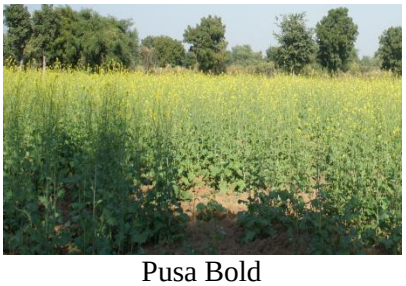
## Result and Discussions

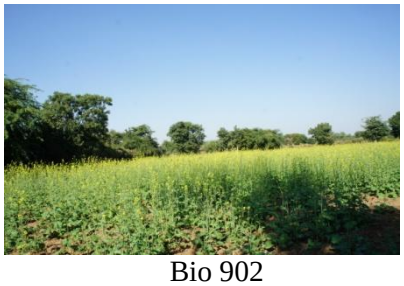
Yield in front line demonstration recorded mustard yield 1364 kg/ha, 1683 kg/ha, 1601 kg/ha, 1512 kg/ha, 1513 kg/ha, 1647 kg/ha and 1572 kg/ha during 2012-13 (Pusa Bold, Bio-902 & Laxmi), 2013-14 (Pusa Bold & Bio-902), and 2014-15 (Bio 902 and Laxmi), respectively (**Table 1**) with an average production was 1556 kg/ha. Comparison study of the productivity level between front line demonstrations and local checks is shown in Table 1. It is evident from results that under the demonstrate plot, performance of mustard (yield) was sustainable higher than that in the local check in all the years of the study (2012-13 to 2014-15). Yield in mustard under demonstration ranged from (1283-1647 kg/ha) during the period of study. Technological intervention, thus, enhanced yield to a tune of 26.77%, 33.15%, 36.14%, 19.06% 18.02%, 29.89% and 32.66%, respectively, over the local check. Fluctuations in yield observed over the years were mainly on account of variation in soil moisture availability, rainfall, sowing time and pest and disease attack. Similar enhancement in yield in mustard and other crops under front line demonstrations was documented by [4, 5, 7-11].

**Table 1** Yield and yield difference of mustard under frontline demonstrations

| Year | Variety | No. of FLD | Yield kg/ha | | Potential yield Kg/ha | Yield difference Kg/ha | Percent increase yield over LC (FP) |
|---|---|---|---|---|---|---|---|
| | | | LC (FP) | FLD | | | |
| 2012-13 | Pusa Bold | 112 | 1076 | 1364 | 1850 | 288 | 26.77 |
| | Bio 902 | 112 | 1264 | 1683 | 2050 | 419 | 33.15 |
| | Laxmi | 112 | 1176 | 1601 | 2100 | 425 | 36.14 |
| 2013-14 | Pusa Bold | 60 | 1270 | 1512 | 1900 | 242 | 19.06 |
| | Bio 902 | 60 | 1282 | 1513 | 1950 | 231 | 18.02 |
| 2014-15 | Bio 902 | 60 | 1268 | 1647 | 1970 | 379 | 29.89 |
| | Laxmi | 60 | 1185 | 1572 | 1880 | 387 | 32.66 |
| Mean | | | 1217.29 | 1556.00 | 1957.14 | 338.71 | 27.96 |

Yield in front line demonstration and potential yield of the crop was compared for estimating yield gaps. These gaps were further categorized as technology and extension gaps. Technology gap indicates a gap in demonstration yield over the potential yield, and this was 486, 367, 749, 388, 447, 353 and 368 kg/ha during 2011-12 (Pusa Bold, Bio-902 & Laxmi), 2012-13 (Pusa Bold and Bio-902), and 2014-15(Bio-902 and Laxmi), respectively (**Table 2**). The technology gap observed may be attributed to dissimilarities in soil fertility, to erratic rainfall, availability of harvested rainwater and other vagaries of weather in the demonstration areas. Hence, to narrow down the gap between the two types of yield in different varieties, location specific recommendation may become necessary.


Pusa Bold


Bio 902

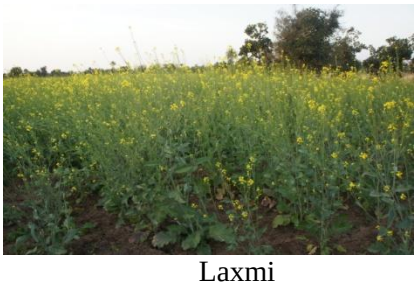

Laxmi

**Table 2** Yield gap and technology index in mustard frontline demonstrations.

| Year | Variety | No. of FLD | Technology gap (Kg/ha) | Extension gap (Kg/ha) | Technology Index (%) |
|---|---|---|---|---|---|
| 2012-13 | Pusa Bold | 112 | 486 | 288 | 26.27 |
| | Bio 902 | 112 | 367 | 419 | 17.90 |
| | Laxmi | 112 | 499 | 425 | 23.76 |
| 2013-14 | Pusa Bold | 60 | 388 | 242 | 20.42 |
| | Bio 902 | 60 | 447 | 231 | 22.81 |
| 2014-15 | Bio 902 | 60 | 353 | 379 | 17.65 |
| | Laxmi | 60 | 368 | 387 | 18.97 |
| Mean | | | 415.43 | 338.71 | 21.11 |

Extension gap 288 kg/ha, 419 kg/ha, 425 kg/ha, 242 kg/ha, 231 kg/ha, 379 kg/ha and 387 kg/ha during 2011-12 (Pusa Bold, Bio-902 & Laxmi), 2012-13 (Pusa Bold and Bio-902), and 2014-15(Bio-902 and Laxmi), respectively with ranged from 231 to 425 kg/ha during the period under study (Table 2). A wide extension gap emphasizes the need to educate farmers using various means to facilitate adoption of improved production technologies, to reverse this trend. Greater use of the latest, improved production technologies applied to high yielding varieties can subsequently bridge this extension gap between demonstration yield and farmer's yield. New technologies, may, eventually lead farmers into discontinuing obsolete varieties. Technology index refer to the feasibility of variety at farmers field. It comprises 26.27%, 17.90%, 23.76%, 20.42%, 22.81%, 17.65% and 18.97% during 2011-12 (Pusa Bold, Bio-902 & Laxmi), 2012-13 (Pusa Bold and Bio-902), and 2014-15(Bio-902 and Laxmi), respectively with mean 21.11 % (**Table 3**). A lower the value of technology index more is the feasibility. This finding of the experiment corroborates results of [4, 5, 7-11].

**Table 3** Economics of Mustard frontline demonstrations

| Year | Variety | Cost of Cultivation (Rs/ha) | | Gross return (Rs/ha) | | Net return (Rs/ha) | | Additional income (Rs/ha) | B:C ratio | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FLD | LC (FP) | FLD | LC (FP) | FLD | LC (FP) | Over FP | FLD | LC |
| 2012-13 | Pusa Bold | 13870 | 12630 | 55924 | 44116 | 42054 | 31486 | 10568 | 3.03 | 2.49 |
| | Bio 902 | 13230 | 12700 | 52603 | 44116 | 39373 | 31416 | 7957 | 2.98 | 2.47 |
| | Laxmi | 14110 | 13015 | 57441 | 44116 | 43331 | 31101 | 12230 | 3.07 | 2.39 |
| 2013-14 | Pusa Bold | 14540 | 13308 | 63504 | 53340 | 48964 | 40032 | 8932 | 3.37 | 3.01 |
| | Bio 902 | 14205 | 13100 | 63546 | 53844 | 49341 | 40744 | 8597 | 3.47 | 3.11 |
| 2014-15 | Bio 902 | 14815 | 13700 | 72468 | 55792 | 57653 | 42092 | 15561 | 3.89 | 3.07 |
| | Laxmi | 14650 | 13570 | 69168 | 52140 | 54518 | 38570 | 15948 | 3.72 | 2.84 |
| Mean | | 14203 | 13146 | 62093 | 49638 | 47891 | 36492 | 11399 | 3.36 | 2.77 |

The economics of growing mustard under front line demonstrations were estimated and results are presented in Table 3. Economic analysis of yield performance revealed that besides higher production, participating farmers in FLDs realized a higher price of than produce compared to that in the local checks during the period under study. This was so because of a better quality of the produce. Front line demonstrations recorded higher mean gross return (Rs 62093/ha) and mean net returns (Rs 47891/ha) as compared to local check (gross return Rs 49638/ha and net return Rs 36492/ ha), respectively. Further, under front line demonstration average benefit: cost ratio (3.36)was recorded as compared to the local checks in our study (2.77). These results are in line with finding of [4, 5, 7-11].

***Existing practices in TSP villages***

- Growing traditional old varieties as sole crop.
- Use improper dose of fertilizers.
- Sowing seeds without any seed treatment.
- Growing crops along the slope without any soil moisture conservation practices.
- Not aware for proper composting.
- No any *in-situ* moisture conservation practice.
- Not proper use of harvested rainwater.
- Pre seasonal trainings were organized in each villges of Mandalgarh and Jahajpur PS.

## Recommendations

- Yield gaps exist in mustard cropping pattern at all trial. It is, therefore, recommended to explore the scope to promote yields of the crops by minimizing the yield gaps using HYVs and improved management practices.
- Frequent interaction between researchers and extension personnel of the trial sites is essential for minimizing yield gaps in these crops. The researchers should develop appropriate technology package and extension personnel at the same time ensure adoption of such technology package by the farmers.
- Results of the on-farm trial conducted at different locations reveal that the farmers apply low and imbalanced doses of fertilizers and pesticides due mainly to resource constraints, It is, therefore, suggested that the farmers are supported by adequate credit facility in time from different institutional sources with easy terms and conditions.
- Farmers should be offered training on the importance of the use of balanced fertilizers, especially micronutrient in mustard for higher yield. They should as well be given training on different areas of pest and water management of the crops.
- It is also essential that adequate funds are released in time for organizing farmer's training programmes and field days on the production technology of the crops.

## Conclusions

On the basis of above finding in present study, it is concluded that front line demonstrations of improved technology reduces technology gap to a considerable extent, thus leading to increased productivity of mustard in Kota district of Rajasthan. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology. Productivity enhancement under FLDs over farmer practices of mustard cultivation created a greater awareness, and motivated other farmers not growing mustard to adopt improved technologies in this seed spice crop I. rape seed and mustard. Therefore, it can be concluded that frontline demonstration conducted under the close supervision of scientists is one of the most important tools of extension 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. Front line demonstrations are playing important role in motivating the farmers for adoption of improved agriculture technology resulting in increasing their yield and profits. Keeping in view of importance in transfer of technology, FLDs should be designed and conducted carefully and effectively and provisions should be made for other supportive extension activities such as field days, interaction meeting, *etc.* for speedy dissemination of demonstrated technology among farming community.

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