Economic Utility Evaluation of Improved Technologies in Indian mustard: An Analysis of Front Line Demonstrations

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ABSTRACT

Rapeseed-Mustard group of crops is one of the major oilseed crops of India. Under the All India Coordinated Research Project on Rapeseed-Mustard (AICRPRM), the technologies developed through research activities are demonstrated under actual field conditions of the farmers through Frontline Demonstrations. From these demonstrations an understanding of the economic potential of each of the selected improved technology is possible. This paper attempts to study the economic performance of individual component technologies recommended for Indian mustard. The data on Frontline Demonstrations (FLDs) conducted under AICRPRM is used in the study. Percentage Yield Increase over Farmers Practice (%YIOFP), Additional Net Monetary returns (ANMR) and Incremental Benefit Cost Ratio (IBCR) are used for comparison between technologies. The results show that Integrated Pest Management Technology recommended for Indian mustard has shown the highest average increase in yield over farmer's practice (23.7%). The highest average increase in ANMR is obtained by the adoption of sulphur application. The IBCR values range from 13.4 in case of sulphur application to 2.4 for IPM strategy. The study shows that there is wide variation between the technologies with regard to their economic potentials. This calls for judicious deliberations in selection of technologies for popularization.

Key words: Frontline demonstration ; Technology component; Additional net monetary returns (ANMR);

The Indian contribution to total rapeseed-mustard acreage and production in world is 25.5 and 14.7 per cent, respectively. In India, these crops during 2006-07 were grown on 6.33 m ha and recorded a yield level of 1057 Kg/ ha. Rapeseed-mustard group of crops contributed 24.1% and 27.1% to the oilseeds acreage and production, respectively during the period from 2001-02 to 2005-06. This crop commodity is the major source of income especially even to the marginal and small farmers in rainfed areas. Rajasthan, UP, MP, Gujarat and Haryana are the major rapeseed-mustard producing states .The technology mission on oilseeds (TMO), established in 1986 was aimed at attaining self reliance in oilseeds.

The benefits accrued from TMO were further strengthened through the ad hoc project on "Frontline Demonstrations in Oilseed Crops" launched from Kharif 1990-91 sponsored by Department of Agriculture and cooperation, Government of India. Under the All India Coordinated Research Project on Rapeseed Mustard, the technologies developed through research activities are demonstrated under actual field conditions of the farmers through Frontline Demonstrations. The results of the frontline demonstrations revealed that still nearly 40-50% realizable yield potential exists.

A targeted and focused approach in spreading the awareness about the improved technologies shall increase the rate of adoption and raise the productivity of the crop. For this an understanding of the economic potential of each of the selected improved technology is necessary. Vast yield gaps still persist between potential yield recorded at Research Station and the frontline demonstrations / on-farm trials. Further, untapped yield reservoir exists between yield obtained in frontline demonstrations and the State / National yield. With the available technologies, it is possible to further increase the rapeseed-mustard production. This paper attempts to study the economic performance of individual component technologies recommended for Indian mustard using the data from Frontline Demonstrations conducted during 2002-2007.

METHODOLOGY

The data on Frontline Demonstrations (FLDs) conducted under All India Coordinated Research Project (Rapeseed- Mustard) (AICRPRM) and published in the Annual Progress Reports of AICRP (RM) for the selected years were used for the study.

The bulk of the Frontline Demonstrations are conducted on Indian mustard which is the major species of oilseed brassica grown in India. For the present study data from only those frontline Demonstrations involving demonstration of component technologies in Indian mustard were taken. The Percentage Yield Improvement over Farmers' Practice (%YIOFP) obtained in demonstration plots across the regions for each component was calculated for each of the cropping season during 2002 to 2007 (Five Cropping seasons).The weighed average value for the five year period was then worked out using the number of demonstrations in each year as weights .One of the assumption while taking the average values was that the error due to change in locations of the trials over different years will be nullified as the number of trials and locations of the trials were fairly large . The Additional Net Monetary Returns (ANMR) for each of the trials is available in the annual progress report and the average values for each component were calculated for each year. The weighed average ANMR for the five year period were also worked out. The ANMR represents the net additional monetary returns received by the farmer who adopts the improved technology as compared to the farmer's traditional practice. To determine the benefits per additional rupee invested on improved technology, Incremental benefit cost Ratio (IBCR) has been calculated as per the following formula

$$IBCR = \frac{\text{Additional Gross Return form Demonstrated Technology}}{\text{Additional Cost Involved in Demonstrated Technology}}$$

From the above calculation ,it is clear that IBCR can be calculated only where the cost and the gross returns form the improved technology was more than the cost and gross return from the farmers' practice respectively (*AICRP-RM, Annual Progress Report, 2005*).

RESULTS AND DISCUSSION

Extent of frontline demonstrations: The number of frontline Demonstrations conducted can be broadly classified into whole package demonstrations where the entire recommended package of practices for the crop is demonstrated against the prevailing farmers' practice and the component technology demonstrations where the advantage of each component of the package is demonstrated. Table 1 shows the total number of FLDs conducted under AICRP(RM) for the five seasons. The percentage of FLDs on Indian mustard is consistently above 65% of the total demonstrations conducted. This shows the importance of Indian mustard under the AICRP project on Rapeseed-mustard. The number of FLDs has more than doubled during the last season. The FLDs on Indian mustard were 421 during 2006-07 as compared to 187 demonstrations during the previous season(2005-06).The number of component technology demonstrations have also shown a proportional jump from 92 to 207 demonstrations during the same period.

Table 1. Year wise break up of FLDs in Indian mustard

Year	FLDs conducted in Indian Mustard	Whole Package FLDs	Component Technology FLDs*	Total No of FLDs under AICRP-RM	2 as % of 5
1	2	3	4	5	6
2002-03	198	118	80	299	66
2003-04	344	240	104	485	71
2004-05	242	78	164	364	67
2005-06	187	95	92	301	62
2006-07	421	214	207	615	69

* Component technology includes the varietal demonstrations also
Source: Various Annual Progress reports –AICRP (RM)

Yield and monetary advantage of technology components: A comparison between different technology components in terms of their yield advantage over farmers' practice clearly brings out the potential of spread of technology in improving the yield levels. The absolute values of improvement in yield expressed in percentage increase over farmers' practice and the additional net monetary returns obtained by adoption of different component technologies are presented in Table 2. The weighed average of percentage yield increase over farmers practice and ANMR for the five year period is presented in table 3.A joint reading of table 2 and 3 will clearly bring out the difference in potential of the various technology components. It can be seen that among the technologies Integrated Pest Management technology recommended for Indian mustard has shown the highest average increase in yield over farmers practise (23.7%).This was followed by weed control strategies (19.1%) and adoption of recommended dose of fertilizers(16.6%).The high impact of weed control demonstration over farmers' practice might be due to the general apathy among farmers to go for weeding

practices in view of high cost and non availability of labour. The lack of visible yield loss due to weed infestation unlike in the case of pest and diseases also work against the adoption of weed control measures by the farmers. The yield advantage of integrated pest management strategies gives the clear indication that an ecologically viable option does not necessarily compromise on the yield attributes of the cropping enterprise.

The highest average increase in ANMR/ ha is obtained by the adoption of sulphur application. The average ANMR is Rs 4331/ha for demonstrations involving application of Sulphur nutrient. This is followed by IPM technology with an ANMR of Rs 4060/ha which is comparable to the ANMR/ha for sulphur application. Weed control gives an average ANMR of Rs 3676/ha over farmers' practice. A noteworthy feature is that the ANMR for IPM, which gave the highest percentage increase in yield over farmers practise, is high when compared to that of other technologies like plant protection and thiourea application. This points to a lower cost of adoption for IPM strategy compared to other technological components. Improvement in methods of IPM which reduce the cost of adoption can be attractive option for the farmers to harness the full benefits of yield advantage and monetary benefits offered by the adoption of IPM strategy.The advantage in terms of yield in the case of Sulphur application (%YOFP = 12.0%) is relatively low (Only thiourea application has a lesser yield advantage). Read along with the highest ANMR for the same technology, it means that the additional cost of adoption of Sulphur application technology is significantly lower. The application of Sulphur has been recommended through such mixed fertilizers which supply Sulphur nutrient along with the basic nutrients like Nitrogen and Phosphorus. This involves only changes in fertilizer composition and does not involve additional labour cost for fertilizer application or other associated incidental costs. The lowest ANMR was recorded by Plant protection technology. This may be reflective of the higher cost of plant protection chemicals used in the crop. In this context, development of cost effective plant protection technologies assume significance.

Table 2. Comparison of yield improvement and additional monetary returns for technologies

Technology	2002-03		2003-04		2004-05		2005-06		2006-07	
	YIOFP (%)	ANMR (Rs/ha)	YIOFP (%)	ANMR (Rs/ha)	YIOFP (%)	ANMR (Rs/ha)	YIOFP (%)	ANMR (Rs/ha)	YIOFP (%)	ANMR (Rs/ha)
	1	2	3	4	5	6	7	8	9	10
Plant Protection	11.2	1319	15.7	2336	15.0	1551	10.9	2529	9.5	1879
Thinning	17.2	3203	12.6	2435	14.7	2243	11.8	1758	9.9	1248
Sulphur Application	33.3	8025	13.7	2386	9.7	6948	15.9	3057	10.7	2364
IPM	13.3	-95	13.4	474	45.1	4159	18.7	1964	21.8	3972
Weed Control	10.6	1825	11.6	3747	22.5	3378	22.3	3362	20.8	4552
Recommended Fertilizer Dose	17.1	3262	12.5	2640	17.3	3904	17.5	1100	18.2	4641
Thiourea	*	*	*	*	11.2	2147	12.0	2709	6.4	1195

* Thiourea demonstration trials were not conducted during 2002-03 and 2003-04

Table 3. Component wise average yield and monetary advantage over farmers' practice (2002-03 to 2006-07)

Technology	Weighed Average YIOFP (%)	Weighed Average ANMR (Rs /ha)
Plant Protection	13.9	2044
Thinning	13.3	2182
Sulphur Application	12.0	4331
IPM	23.7	4060
Weed Control	19.1	3676
Recommended Fertilizer Dose	16.6	2327
Thiourea	10.2	2101

Returns to investment in component technologies: The returns to investment determine the profitability and ultimately the extent of adoption of a technology. The Incremental Benefit cost ratio for the component technologies is presented in table 4. The IBCR values range from 13.4 in case of Sulphur application to 2.4 for IPM strategy. The fact that all the component technologies have an average IBCR value of above one shows that the technologies transferred to the farmers are economically viable . But large differences in IBCR values between technologies may cause differential rate of adoption between technologies. Based on the IBCR

values it can be seen that Sulphur application has got significant economic benefit.

Table 4. Incremental benefit cost ratio of component technologies in Indian mustard

Technology	2002-03	2003-04	2004-05	2005-06	2006-07	Weighed Average IBCR
Plant Protection	3.6	3.2	3.6	3.3	3.0	3.3
Thinning	9.5	3.2	2.6	2.0	6.3	4.5
Sulphur Application	108.0	47.7	9.9	6.2	3.7	13.4
IPM	0.9	1.3	2.4	1.7	3.3	2.4
Weed Control	4.3	5.1	7.4	5.6	9.3	6.9
Recommended Fertilizer Dose	3.3	3.7	5.2	1.3	10.5	5.8
Thiourea Application	-	-	4.2	8.1	3.0	5.4

A perusal of Table 4 reveals that there is a lot of variation in IBCR value between years for most of the technologies. This points to a lack of stabilisation of technologies and the location specific nature of the technologies. The fact that the technologies may not be location independent has got implications in the selection of the appropriate technology for each agro climatic location. Though the data on thiourea application technology is available only for three years, it can be seen from the IBCR values that this technology has got good potential to be a viable technology in the farmer's fields. The low returns to additional investment in adopting IPM strategies(IBCR=2.4) fails to account for other non economic benefits that may accrue through lower environmental pollution and benefits to ecological balance. Even then efforts should be taken to make IPM adoption more lucrative in the monetary sense so that the adoption rates can be increased.Similarly reported by *G.V. Ramanjaneyulu et. al. (1988-89 to 1997-98), Kiresur. V.R., S.V. et. al. (2001) and Mruthyunjaya et al., (2005).*

CONCLUSION

The study shows that there is wide variation between the technologies with regard to their economic potentials. This calls for informed deliberations in selection of technologies for popularisation. The use of IBCR as a measure of returns on additional investment does not fully capture the yield advantage due to the adoption of technology hence an integrative method involving the use of all the three parameters used in this study i.e., Percentage Yield Increase Over Farmers Practice, Additional Net Monetary Returns and Incremental Benefit Cost Ratio should be used in the selection of the ideal combination of technology for the farmer. The study of the different technology components in Indian mustard showed that the technologies like IPM strategies and weed control gave excellent yield advantage when compared to other technologies .Based on IBCR values Sulphur application was followed by weed control in terms of profitability of additional investment. The Frontline Demonstrations in rapeseed mustard provide useful information regarding the scope and economic viability of the technologies developed for the crop. To supplement the extension efforts, selection of appropriate technology using economic parameters will be of significant help. The integration of the different economic criteria into a comprehensive selection criterion need to be explored for better utilisation of these criteria.

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