



Upscaling the Yield in *Brassica rapa* Var Brown Sarson at Farmers Field Through Frontline Demonstrations under Temperate Hill Ecology of Kashmir

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ABSTRACT

Background: Rapeseed is an important edible oilseed crop around the globe, cultivated across different agro ecologies. In Kashmir valley the difference in the productivity of rapeseed realized at farmers field and its potential yield is tangible. In this context present study was carried out to demonstrate the impact of good agricultural practices (GAP) on rapeseed crop at farmer's field, employing frontline demonstrations (FLDs).

Methods: The study on FLDs was conducted on rapeseed crop over a period of five years from 2017-18 to 2022-23 covering an area of 180 acre of agricultural land. Three newly released high yielding varieties following recommended package of practices were evaluated at farmer's field against the farmers own practice of rapeseed cultivation. Comparison among the treatments was tested at 5% level of significance employing student's 't' test.

Result: Transfer of technology at farmers field witnessed a significant enhancement in the seed yield through improved practice (1151 kg ha⁻¹) compared to farmers practice (983 kg ha⁻¹) with an average yield advantage of 17%. The investigation also revealed varying extension and technology yield gaps ranging between 158 to 174 kg ha⁻¹ and 317-637 kg ha⁻¹, respectively. These findings underscored significant role of adopting improved practices in enhancing the seed yield. Technology index of 31% reflects the sensitivity and the urgent need for more cohesive endeavours aimed at dissemination of improved technology at farmer's field. The adoption of improved practice yielded additional gains (₹2088 ha⁻¹), higher gross returns (₹52339 ha⁻¹) and benefit: cost ratio (1.92).

Key words: Brown sarson, Economics, Front line demonstration, Rapeseed, Yield.

INTRODUCTION

Rapeseed-mustard holds significant agricultural importance as an edible oilseed crop cultivated across diverse agro climatic regions globally and it ranks third after groundnut and soybean. In India, rapeseed-mustard crops cover approximately 9.18 million hectares, accounting for 25% of the global acreage dedicated to these crops (Agri. Stat, 2023). In Jammu and Kashmir, rapeseed is cultivated over an area of 46 thousand hectares, the major chunk of which belongs to Kashmir valley (80%) with the average productivity of 8.31q ha⁻¹ (DOSTAT, 2023). In the Kashmir valley *Brassica rapa* var Brown sarson has a great significance as it is the only winter season oilseed crop that effectively integrates in rice-based cropping system (Jehangir *et al.*, 2019). Rapeseed is sown shortly after the harvest of proceeding *kharif* season rice crop and it remains in the field for seven to eight months. During this period crop experiences a harsh winter season wherein the temperatures can drop down to as low as -10°C. This exposes the crop to sub-zero temperature resulting slow growth altogether (Jehangir *et al.*, 2024). Yield is a complex trait, influenced by multifarious factors including genetic, agronomic practices and climatic conditions. Increasing demand for vegetable oil on one side and shrinking land resources on the other side make the situation complex. Increase in production per unit area therefore seems to be

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the only way out for sustaining oilseed production in the valley. However, the sub optimal use of agronomic practices alongside the selection of inappropriate cultivars has led to sub optimal yield at farmer's field (Sheikh *et al.* 2013; Mubarak and Shakoor, 2019). In view of this, a series of FLDs were conducted across the length and breadth of Kashmir valley to showcase the impact of recommended agricultural practices on productivity of Brown sarson at farmer's field.

MATERIALS AND METHODS

The study area for demonstration consisted of major oilseed growing areas of Kashmir valley comprising districts namely Anantnag, Kulgam and Pulwama in the south, Budgam in the central and Bandipora, Baramulla and Kupwara in the North of Kashmir is depicted in the Fig 1. Over the years three high yielding varieties of Brown sarson viz. Shalimar sarson -1, Shalimar sarson-2 and Shalimar sarson -3, along with recommended package of practice were tested against the local varieties under traditional method of cultivation. The technical intervention undertaken is depicted in Table 1. A total of 180 demonstrations were carried out from 2017-18 to 2022-23. The demonstration covered an area of 1 acre each, with 50 % of the selected area put under recommended practice i.e. growing newly released high yielding variety under advanced method of cultivation,

designated as improved practice (IP) and the remaining half cultivated traditionally was designated as farmer practice (FP). Crop was sown soon after harvesting of the proceeding rice crop during first fortnight of October at recommended rate of 0.5-0.7 kg ha⁻¹ under IP and harvested in the month of May. Yield of the crop under IP was recorded at 10 % moisture content and compared against FP. The economics was calculated on the basis of prevalent market rates. Additionally, extension gap, technology gap, technology index and benefit cost ratios were calculated using following formulae.

Additional gains=

$$\text{Net returns (} \text{`ha}^{-1} \text{) from Improved practice} - \text{Net returns (} \text{`ha}^{-1} \text{) from farmers practice}$$

Effective gains (`ha⁻¹) =

$$\text{Additional returns (} \text{`ha}^{-1} \text{) - Additional costs (} \text{`ha}^{-1} \text{)}$$

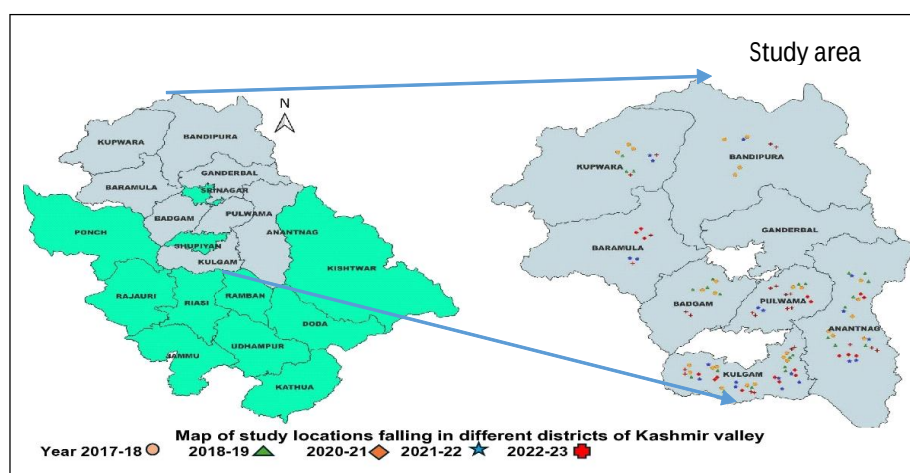


Fig 1: Map of Jammu and Kashmir and the study area where FLDs were conducted.

Table 1: Technological interventions implemented through FLDs at farmers field.

Component	Improved practice	Farmers practice
Variety	Shalimar sarson -1,2 and 3	Local
Seed rate	7.5 kg ha ⁻¹ .	Higher seed rate (15 to 20 kg ha ⁻¹)
Time of sowing	1 st fortnight of October	2 nd fortnight of October to 1 st week of November.
Spacing	30×10 cm	Broadcasting
Fertilizer dose	Balanced fertilization as per recommendation N: P ₂ O ₅ : K ₂ O: S at the rate of 80:50:40 kg ha ⁻¹ , respectively. With nitrogen applied in three equal splits (1/3 rd as basal, 1/3 rd in 1 st week of March and 1/3 rd at flowering). Basal dose of nitrogen along with full dose of phosphorus and potassium were applied at the time of sowing.	Indiscriminate use of fertilizers particularly nitrogen is used in bulk quantities.

Extension gap (kg ha^{-1}) =

Yield obtained under IP - Yield obtained under FP

Technology gap =

Potential yield of the variety - Yield obtained under IP

Technology index (TI) =

$$\frac{\text{Potential yield} - \text{Demonstrated yield}}{\text{Potential yield}} \times 100$$

$$\text{Benefit cost ratio} = \frac{\text{Gross returns } \text{ha}^{-1}}{\text{Cost of cultivation } \text{ha}^{-1}}$$

To test the significance among the production practices, 't' test was used and the effects were accepted as significant if $p \leq 0.05$.

RESULTS AND DISCUSSION

The study was conducted from 2017-18 to 2022-23 to showcase the impact of improved technologies in rapeseed through FLDs. In general, regardless of year of demonstration, improved practice (IP) registered significantly higher seed yield compared to farmer's practice (FP) (Table 1 and Fig 2 a-e). Average yield secured under IP ranged from 1063 to 1307 kg ha^{-1} with a yield

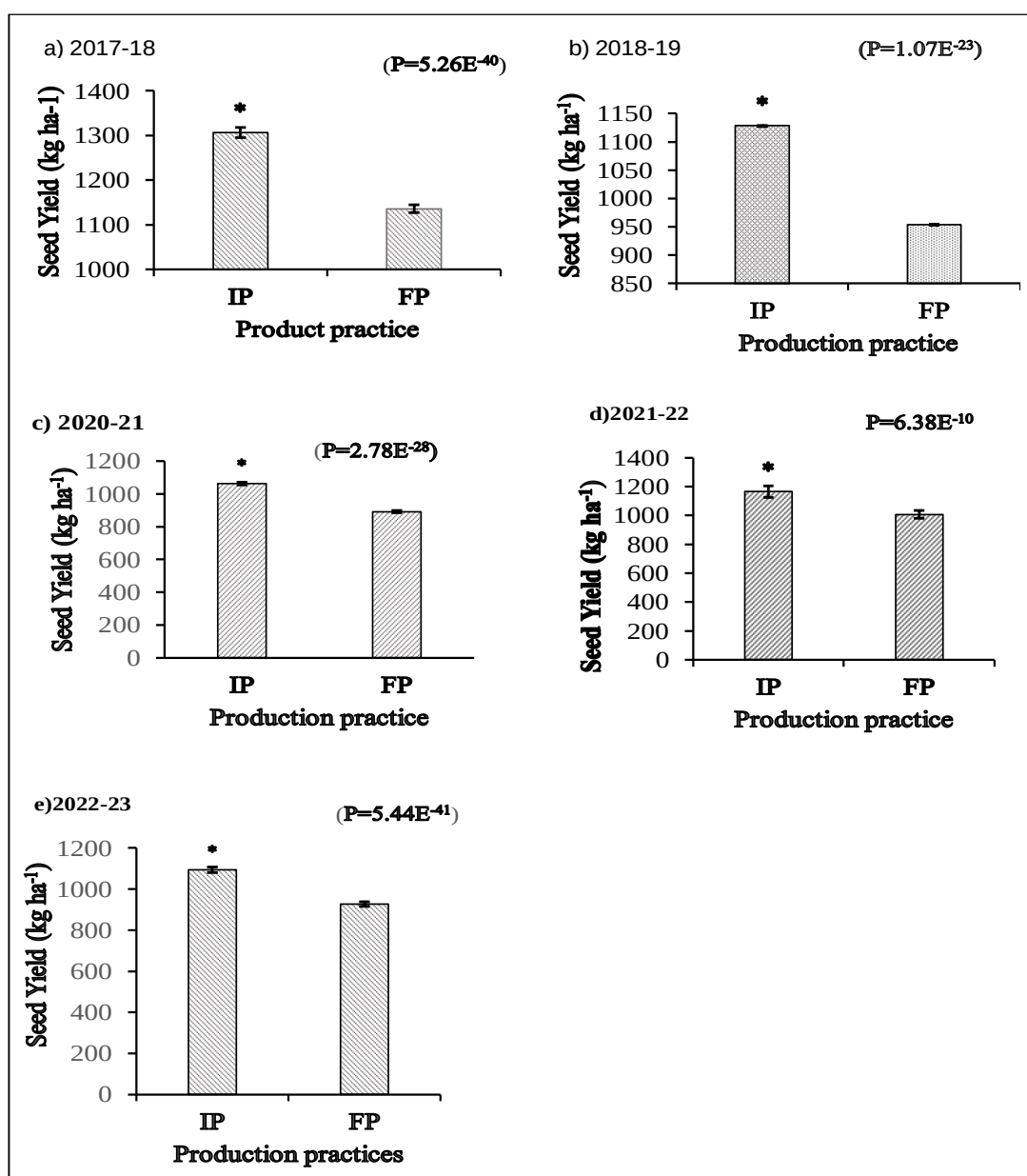


Fig 2: Influence of production practices on Brown sarson yield at farmers field from 2017-18 to 2022-23(a-e).

*Significant at $p \leq 0.05$.

Table 2: Seed yield and gap analysis of Brown sarson varieties under front line demonstration programme.

Year	Number of FLDs	Average yield (kg ha ⁻¹)		Per cent increase in yield (%)	Extension gap (EG) kg ha ⁻¹	Technology gap (TG) kg ha ⁻¹	Technology index (TI) (%)
		IP	FP				
2017-18	50	1306.6	1136.0	15.0	170.7	317.3	19.55
2018-19	30	1128.3	954.1	18.36	174.2	544.9	32.50
2020-21	30	1063.3	891.9	19.22	171.3	636.7	37.45
2021-22	20	1165.8	1007.5	15.23	158.33	534.1	31.4
2022-23	50	1093.3	927.82	17.74	165.48	606.7	35.68

Table 3: Economic analysis of FLDs in rapeseed (*Brassica rapa* var Brown sarson).

Year	Input cost		Additional cost in IP	Gross returns		Net returns		Additional returns IP	Effective Gain from IP	B: C ratio			
	(` ha <sup>-1</sup>)			(` ha ⁻¹)		(` ha <sup>-1</sup>)				(` ha ⁻¹)	IP (` ha ⁻¹)	FP	IP
	FP	IP		FP	IP	FP	IP						
2017-18	24230	25680	1450	51120	58800	26890	33120	6231	4781	2.11	2.29		
2018-19	23997	26152	2155	45794	54162	21797	28010	6213	4058	1.91	2.07		
2020-21	27860	31322	3462	49060	58482	21200	27160	5960	2498	1.76	1.87		
2021-22	38018	39155	1137	55412	64122	17394	24967	7573	6436	1.46	1.64		
2022-23	38904	41142	2238	60310	71061	21406	29929	8513	6275	1.55	1.73		
Average	30602	32690	2088	52339	61325	21737	28637	6898	4810	1.75	1.92		

superiority of 17 % over FP. Higher yield obtained under IP can be ascribed to better exploitation of inherent potential of the variety with optimum management practices. The difference in the observed yield between the years can be attributed to a number of factors major being variability in soil fertility and climatic conditions. Similar increment with the intervention of new practices was also observed by Kumari and Singh (2022); Mubarak *et al.* (2023a) and Rani *et al.* (2024). Shankar *et al.* (2023) also reported positive impact of improved technologies demonstrated on farmers field, with the mean yield increment of 8.3% in rice crop over three year period.

Gap analysis

The yield gap analysis in the present study revealed an extension gap ranging between 158 to 174 kg ha⁻¹, with the average value of 168 kg ha⁻¹ and technology gap between 317-637 kg ha⁻¹ with the average value of 528 kg ha⁻¹. These results indicate that there is a greater scope for yield enhancement in the rapeseed in valley owing to lack of awareness among the farmers regarding recommended practices for cultivation of Brown sarson. Farmers are still cultivating rapeseed traditionally like using traditional variety with lower genetic potential, unbalanced use of fertilizers and higher seed rate. This indicates lack of awareness among the farmers about recommended and improved technologies, underscoring the need for awareness programmes to inculcate needful information among the farming community for realising potential yield in rapeseed. Likewise technology gap also varied between 317 to 637 kg ha⁻¹. Since technology gap reflects that potential yield couldn't be obtained owing to variable soil health, planting time and agro-climatic parameters (Kumar *et al.*, 2019;

Kumari and Singh, 2022). Thus highlighting need for site specific crop management.

Technology index which is an indicator of feasibility of the evolved technology at the farmers field varied between 19-37% (Table 2). The results are indicative of the fact that to optimize the productivity, there is a need to bridge extension and technology gaps by employing site specific intervention as has been reported by Mitra and Samajdar (2010) and Dhaka *et al.* (2010).

Economic analysis

All the economic parameters like input cost, gross returns and net returns varied between the years and among the practice of oilseed cultivation (Table 3). In the FP input cost varied from `23997 ha<sup>-1</sup> in the year 2017-18 to `38904 ha⁻¹ in 2022-23 and in improved practice it varied from `25680 to `41142 ha⁻¹ during the respective years. This was due to variation in cost of inputs over the years. On an average the cost of inputs was Rs 30602 ha⁻¹ and Rs. 32690 for farmers and improved practice, respectively. Benefit cost ratio was also found to be variable among the years with higher values registered in IP over FP. Mean B: C ratio of 1.92 and 1.75 was registered with IP and FM, respectively. These higher values registered with IP can be attributed to additional gains recorded under IP on account higher productivity. These findings are also in line with Verma *et al.* (2017); Kumar *et al.*, 2019; Kumari and Singh (2022) and Mubarak *et al.*, (2023b) who in their study also recorded higher input and B:C ratio under IP compared to FP.

CONCLUSION

The present study led to the conclusion that conducting FLDs at the farmer's field is an effective means of bridging

extension and technology gap for seeking the potential yield.

Furthermore, given the existing gaps in extension and technology, further highlights the scope for yield increment in Brown sarson crop through IP. Hence there is a dire need for further strengthening the extension to disseminate the information pertaining to utility of IP in seeking higher yield and economic benefit.

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Conflict of interest

All authors declare no conflict of interest.

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