Research Note

Indian Journal of Extension Education
Vol. 60, No. 2 (April–June), 2024, (109-112)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

An Analysis of Demonstrations on Rapeseed in District Ferozepur of Punjab

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ARTICLE INFO

Keywords: Rapeseed, Gobhi sarson, GSC 7, Yield, Nutritional security, Economics

https://doi.org/10.48165/IJEE.2024.602RN4

Conflict of Interest: None

Research ethics statement(s):
Informed consent of the participants

ABSTRACT

Punjab Agricultural University Farm Advisory Service Centre, Ferozepur conducted demonstrations on rapeseed (gobhi sarson variety GSC 7) on farmer's fields in district Ferozepur during *rabi* seasons (October to March) during the years 2019-20, 2020-21, 2021-22 and 2022-23 in 20.71 ha area, respectively. Punjab Agricultural University recommended variety GSC 7 of gobhi sarson with improved agricultural practices in demonstration plots produced significantly higher grain yields of 22.4, 22.2, 20.1, and 21.3 q ha^{-1} as compared to 17.2, 14.8, 15.6, and 17.8 q ha^{-1} in check plots during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively. Demonstration plots recorded an average increase in yield of 24.5 per cent over check plots. The average extension gap, technology gap, and technology index were 5.2 q ha^{-1}, 3.5 q ha^{-1}, and 14.0 per cent, respectively. A higher average net return of Rs. 73511.3 ha^{-1} was obtained in demonstration plots, which was 30.9 per cent greater than check plots with a net return of Rs. 50768.8 ha^{-1}.

INTRODUCTION

Edible oil and protein being an integral part of diet obtained from oilseeds and pulses (Jakhar & Kumar, 2022). Rapeseed along with oil contain high-quality protein which is source of many essential amino acids far better than cereals (Thanaseelaan, 2013). Rapeseed varieties grown today like GSC 7 has been changed from traditional types. GSC 7 is a canola quality ('00') hybrid of gobhi sarson with < 2 per cent erucic acid in the oil and < 30 µmol of aliphatic glucosinolates in the meal (Gill, 2021). Punjab, the food bowl of India, has achieved the target of food security at the cost of pulses and oilseeds. Rapeseed and mustard grown on 43900 ha with a production of 69300 tonnes and recorded an average yield of 15.8 q/ha during 2021-22 in the Punjab state (Statistical Abstract, 2022). Free electricity, availability of irrigation water and procurement of rice and wheat at minimum support price established monoculture of paddy and wheat in Punjab which led to degrading of the soil, decline in ground water table and crop residue burning. Productivity of cereals has reached its maximum limit with declining profitability and yield stagnation. Low yield, low return, inappropriate technology and lack of assured market were main reasons for not increasing the area under oilseeds and pulses. Higher yield and income from oilseeds and pulses could be achieved with assured market, strong price incentive and appropriate technology development (Grover & Singh, 2012). Agricultural advisory services are very important to fill the gap between knowledge of new agricultural technology, improved cultivation practices and adoption at farmer fields by conducting campaigns, frontline demonstrations and adaptive research trials etc. This article focused on demonstrations conducted by Punjab Agricultural University Farm Advisory Service Centre, Ferozepur, with an objective to analyse the demonstrated technology with farmers' practices at farmer field in district Ferozepur of Punjab state.

METHODOLOGY

The study focused on the yield gap between demonstrated improved cultivation practices and farmers' traditional practices at farmer fields. Punjab Agricultural University (PAU) Farm Advisory Service Centre (FASC), Ferozepur conducted demonstrations on rapeseed on farmer's fields in district Ferozepur. Gobhi sarson

Received 15-03-2024; Accepted 30-03-2024

demonstrations were conducted as rapeseed during winter (*rabi*) seasons (October to March) of the years 2019-20, 2020-21, 2021-22 and 2022-23. FASC, Ferozepur conducted 448, 96, 30 and 69 demonstrations of gobhi sarson on 20.71 ha area. PAU recommended variety of gobhi sarson under demonstration was GSC 7. The demonstrations were evaluated against farmer's local varieties and cultivation practices as check plot. Farmer's local variety means variety purchased from local market from open bags without any assurity of variety and variety name. Improved practices recommended by PAU were strictly followed from sowing to harvesting in demonstration plots. Seed yield data of demonstrations was recorded and subjected to analysis of variance (ANOVA) using SPSS (SPSS Inc., Chicago, USA). Least Significant Difference (LSD) post hoc test at 95% confidence interval separated mean differences. Seed yield data is given in quintals per hectare (q ha^{-1}). The data on extension gap, technology gap and technology index were calculated (Katare et al., 2011).

The cost of cultivation and returns were calculated by taking into account the prevailing cost of inputs and prices of output. The cost of cultivation included expenses for crop production such as seed, seed treatment cost, fertilizers cost, plant protection cost, irrigation cost, human labour hours cost, harvesting cost, tractor hours cost. Interest on variable costs and marketing charges were not included. Gross return included the total value of grain yield. The gross returns, net returns and benefit cost ratio (B:C ratio) was calculated by using the formula (Kumar & Meena, 2021).

RESULTS

In demonstration plots gobhi sarson variety GSC 7 was demonstrated in comparison to local variety in plot with farmers' practices. Farmers were using less quantity of seed as compared to recommended quantity of seed. Farmers sown seed of gobhi sarson late and applied excess dose of fertilizer than recommended (Table 1).

Yield performance and yield gap

Demonstration plots with PAU recommended variety GSC7 of gobhi sarson recorded significantly higher grain yield 22.4, 22.2, 20.1 and 21.3 q/ha than check plots having grain yield 17.2, 14.8, 15.6 and 17.8 q ha^{-1} during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23 (Table 2). Demonstration plots gave 23.2, 33.3, 22.3 and 16.4 per cent more grain yield than check plots during *rabi* season of 2019-20, 2020-21, 2021-22 and 2022-23, respectively. The yield gap analysis was estimated through extension gap, technology gap and technology index. The extension gap was 5.2, 7.4, 4.5 and 3.5 q ha^{-1} during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively (Table 2). The technological gap was 2.6, 2.8, 4.9 and 3.7 q ha^{-1} during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively. The technology index was 10.4, 11.2, 19.6 and 14.8 per cent during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively.

Economics analysis

Economics analysis of demonstrations on gobhi sarson (Table 3) revealed that expenditure incurred on cultivation practices viz. land preparation, seed cost, seed treatment, fertilizers, insecticide and the cost of cultivation increased the cost of cultivation in demonstrated plots as compared to check plots in all four cropping seasons. Demonstration plots recorded higher average gross return (Rs. 99120, Rs. 103230, Rs. 101505 and Rs. 116085 ha^{-1}), net return (Rs. 67812.5, Rs. 71842.5, Rs. 70017.5 and Rs. 84372.5 ha^{-1}) with an average benefit-cost ratio of 3.2, 3.3, 3.2 and 3.6 as compared to gross return (Rs. 76110, Rs. 68820, Rs. 78780 and Rs. 97010 ha^{-1}), net return (Rs. 46802.5, Rs. 39482.5, Rs. 49382.5 and Rs. 67407.5 ha^{-1}) in check plots with an average benefit-cost

Table 1. Cultivation practices of demonstration and farmers' practice plots

Particulars	Demonstration plot*	Farmers' practice
Variety	GSC 7	Local
Seed rate (kg/ha)	3.75	1.5
Sowing time	10^{th} to 30^{th} October	5^{th} to 30^{th} November
Line spacing (cm)	45	45
Fertilizer application kg/ha	Urea 225, Superphosphate 187	Varied dose
Weed management	Hoeing	Hoeing
Plant protection	Need based and at appropriate dose and time	Blanket spray

*Package of practices for gobhi sarson as per recommendations of PAU, Ludhiana, Punjab, India

Table 2. Grain yield, extension gap, technological gap and technology index in demonstrations of gobhi sarson

Year	Grain yield (q ha^{-1})			Increase in yield (%)	Extension gap (q ha^{-1})	Tehnological gap (q ha^{-1})	Technology index (%)
	Potential	Demonstration	Farmers' practices				
Rabi 2019-20	25	22.4a*	17.2b*	23.2	5.2	2.6	10.4
Rabi 2020-21	25	22.2a	14.8b	33.3	7.4	2.8	11.2
Rabi 2021-22	25	20.1a	15.6b	22.4	4.5	4.9	19.6
Rabi 2022-23	25	21.3a	17.8b	19.2	3.5	3.7	14.8
Average	-	21.5	16.3	24.5	5.2	3.5	14.0

*Alphabets a and b with grain yield values indicate significant difference between grain yield under both treatments

Table 3. Economics analysis of demonstrations on ghobi sarson

Particulars	Demonstration	Farmers' practices	Additional return (Rs/ha)
Rabi 2019-20			
Grain/seed yield (q/ha)*	22.4	17.2	5.2
Cost of cultivation (Rs/ha)**	31307.5	29307.5	2000
Gross return (Rs/ha)***	99120	76110	23010
Net return (Rs/ha)	67812.5	46802.5	21010
B:C ratio	3.2	2.6	0.6
Rabi 2020-21			
Average grain/seed yield (q/ha)*	22.2	14.8	7.4
Cost of cultivation (Rs/ha)**	31387.5	29337.5	2050
Gross return (Rs/ha)***	103230	68820	34410
Net return (Rs/ha)	71842.5	39482.5	32360
B:C ratio	3.3	2.3	1
Rabi 2021-22			
Average grain/seed yield (q/ha)*	20.1	15.6	4.5
Cost of cultivation (Rs/ha)**	31487.5	29397.5	2090
Gross return (Rs/ha)***	101505	78780	22725
Net return (Rs/ha)	70017.5	49382.5	20635
B:C ratio	3.2	2.7	0.5
Rabi 2022-23			
Average grain/seed yield (q/ha)*	21.3	17.8	3.5
Cost of cultivation (Rs/ha)**	31712.5	29602.5	2110
Gross return (Rs/ha)***	116085	97010	19075
Net return (Rs/ha)	84372.5	67407.5	16965
B:C ratio	3.6	3.3	0.3

*Grain/seed yield of gobhi sarson is average grain/seed yield of demonstrations conducted during the period under study.
**Cost involved in cost of cultivation of gobhi sarson - seed, seed treatment cost, fertilizers cost, plant protection cost, irrigation cost, human labour hours cost, harvesting cost, tractor hours cost. Interest on variable costs and marketing charges were not included.
***Gobhi sarson gross return included value of grain yield. MSP of sarson was Rs. 4425, 4650, 5050 and 5450 per quintal during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively.

ratio of 2.6, 2.3, 2.7 and 3.3 during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively. An additional return of Rs. 21010, Rs. 32360, Rs. 20635 and Rs. 16965 ha^{-1} were observed from the demonstrated plots during *rabi* 2019-20, 2020-21, 2021-22 and 2022-23, respectively. Similar findings were reported by Singh et al., (2019); Meena et al., (2020); Sangwan et al., (2021).

DISCUSSION

Inappropriate use of inputs and late sowing of gobhi sarson in farmers' practices plots of demonstration resulted in lower average grain yield (16.3 q ha^{-1}). Improved cultivation practices in demonstration plots resulted in average 24.5 per cent increase in grain yield ha^{-1}. Higher grain yield in demonstration plots may be due to adoption of improved variety and cultivation practices. These findings are in accordance with the finding of Nain et al., (2015); Dhaka et al., (2015); Jha et al., (2021); Gill (2021). Extension gap ranging between 7.4-3.5 q ha^{-1} during the study period emphasizes the need to educate the farmers through various extension activities like awareness camps, training programmes, kisan gosthis which have the potential to transfer knowledge about new agricultural technology and improved cultivation practices for crop production from laboratory to farmers' fields which lead to reduction in extension gap (Singh et al., 2019; Kumar & Kispotta, 2017). Technology gap ranging between 4.9-2.6 q ha^{-1} was observed during the study may be ascribed to variation in soil fertility, weather conditions at maturity of crop, crop management practices etc. Therefore, location specific crop management practices should be recommended to achieve potential demonstration yield (Kalita et al., 2019; Chaudhary et al., 2018). Technology index ranging between 19.6-10.4 per cent shows a gap between new agricultural technology generated at the research institution and its adoption by farmers (Dhaka et al., 2010). Different extension activities can play a vital role in proper adoption of demonstrated technical interventions by the farmers which lead to increase the yield performance of gobhi sarson. Cost of cultivation in demonstrated plots was higher as compared to check plots due to more expenditure incurred on cultivation practices. However, gross return and net return were higher in demonstration. This may be ascribed to the use of improved practices (seed, fertilizer, time and method of sowing, weed management, plant protection) and technology in demonstration plots. Higher average gross return and net returns in demonstrated plots was due to higher grain yield. The higher benefit-cost ratio of demonstration plots indicating the economic viability of the recommended technology and practices in cultivation of rapeseed crop (Sharma et al., 2022; Kumar et al., 2022).

CONCLUSION

Demonstration plots with improved variety and practices gave significantly higher grain yield as compared to check plots

with farmers' local practices. The gross returns, net returns and benefit-cost ratio were higher in demonstration plots. Rapeseed yield and economic returns can be rise with adoption of improved scientific technology and practices. Superior yield performance of demonstration plots stimulated farmers to adopt improved variety of gobhi sarson (GSC 7) and new scientific technology. The extension agencies should conduct demonstration on farmers' fields on a large scale to disseminate new agricultural technology and make farmers to adopt it.

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