Indian Journal of Extension Education
Vol. 54, No. 2, 2018 (120-125)

Sesamum Technology: A Crop Diversification Alternative in Punjab

Parminder Kaur[1] and Narinderpal Singh[2]

ABSTRACT

Sesamum can play an important role in crop diversification in specific locations. Due to its good demand in local market there is a need to raise the *Sesamum* production through increase in area and productivity. To promote its new technology, Punjab Agricultural University, Ludhiana has conducted frontline demonstrations in Punjab during *Kharif*, 2016 for testing and popularizing *Sesamum* variety in Punjab Til No.2. The study based on 8 front-line demonstrations conducted in Amritsar district of Punjab reveals that the cultivation of *Sesamum* can be a viable alternative to paddy crop under scarce water resources in general and for small farmers, in particular, having lesser staying power to get assured irrigations. The *sesamum* variety recorded plant height (138.78 cm), no. of plants /m^2 (52), no. of pods /plant (99.5), weight of 100 seeds (3.46 g), and no. of seeds/pod (100.5). The demonstrated technology recorded grain yield 5.50 q/ha which is 83.96 per cent higher yield than local check variety. The benefit-cost (B:C) ratio of this technology was 1.01. The insect pest and diseases were in the range of 0.25 to 1.50 and 0.25 to 2.50 per cent respectively. The technology gap, extension gap and technology index were 1.50 q ha-1, 2.55 q ha-1 and 21.42 per cent respectively. It was also observed that the productivity of *Sesamum* can be doubled with the help of available advanced technology.

Keywords: Front-line demonstration, extension gap, sesamum, technology gap, technology index

INTRODUCTION

Oilseed crops occupy an important position as commercial crops after cereals. India is the largest producer of oilseeds in the world with shares of 14 per cent area and contribution of 7 per cent vegetable oils (Jha *et al*, 2012). Due to increase in world population, demand for quality seed oils continuously grows up. The fluctuations in yield of oilseed crops are due to continuous cultivation of oilseeds in rainfed areas comprising mostly marginal and sub-marginal lands. The major oilseed crops grown in India are rapeseed mustard, groundnut, soybean, *Sesamum*, sunflower, linseed *etc*. Out of these crops, *Sesamum* (*Sesamum indicum* L.), also known as til, is one of the important ancient oilseed crops. *Sesamum* is grown in around 65 countries of the world. India is considered to be its secondary centre of origin after Africa as many wild species are native to the continent. It is recognized as the king of oilseeds because of rich source of oil (50-60%) and protein (18-20%) content (Toan *et al.*, 2010). In India, *Sesamum* is grown both in winter as well as in summer season; most of it is cultivated as *Kharif* crop. It can be used as oil, food (raw or roasted) as well as in bakery products and also in candy industry (Hansen, 2011). The presence of polyunsaturated fatty acids in *Sesamum* oil makes *Sesamum* as an important crop due to its superb effects on health. The quality of its oil is highly stable and

Farm Advisory Service Centre (Punjab Agricultural University), Amritsar-143601, Email: pksehajpal@pau.edu

does not rancid. The seeds are very nutritious in nature and are used in making of different products like mixing in jaggery, biscuits, sweets etc. After the extraction of oil, the leftover residue can also be used as a good feed for the animals.

The production of *Sesamum* in 2015-16 across the country was 850 mt, cultivated in an area of 1950.88 hectares and the average yield was 436 Kg/ha (Anon, 2016). In India, it is cultivated in West Bengal, Orissa, Andhra Pradesh, Assam, Chattisgarh, Gujarat, Madhya Pradesh, Rajasthan, Tamil Nadu, Karnataka, Punjab, Jammu and Kashmir *etc*. In Punjab, It is grown over an area of 4.7 thousand ha and producing over 1.6 thousand tonnes of seed with average yield of 3.3 q/ha (Anon, 2017). The crop can be cultivated as a rainfed crop in the *Kharif* season. It may play an important role in income augmentation of small and marginal farmers. The main limitation for low yield in *Sesamum* is that the production technology is not appropriate like broadcasting method of sowing, no use of fertilizers and not proper management of weeds (Khaleque and Begum, 1991). Many biotic, abiotic, and socio-economic factors restrain the yield potential and there is need to raise the *Sesamum* production through increase in area and better adoption of improved technology. Keeping in view all the issues, frontline demonstrations study was conducted in Amritsar district of Punjab to demonstrate the yield potential and profitability through the improved technology.

METHODOLOGY

This study confined to Amritsar district for dissemination of better technologies and its testing under location specific situations in the Punjab State. Punjab is divided into six Agro-climatic zones, in which Amritsar district comes under Central Plain zone. The climatic conditions of this area are semi-humid, and it thrives best on well drained, sandy loam soils. Eight farmers each having one acre of cultivated land of Amritsar district were selected randomly by Farm Advisory Service Centre (FASC), Amritsar for popularizing *Sesamum* variety Punjab Til No.2 which was released in the year 2015. The seeds of this *Sesamum* variety were supplied to the farmers. The demonstrations were conducted on half acre area with one kg/acre given seed. To minimize the risk of phyllody, farmers were advised to sow the crop during the first fortnight of July, 2016. The sowing was done at row to row spacing of 30 cm with plant to plant spacing of 15 cm and depth of 4 to 5 cm. A basal application of 22.5 kg Urea was drilled before sowing to the crop. To keep the weed flora under check one hoeing was given three weeks after sowing. Weeds were controlled effectively by pre-emergence application of Lasso 50 EC (Alachlor) at the rate of 1200 ml per acre in 200 litres of water within two days of sowing was applied. The incidence of insect pest and disease was calculated from time to time during season in all the plots. After harvesting the plants were tied into small bundles for stacking. The yields were obtained and various economic and agronomic observations were also calculated from the selected plots. Observations on various parameters like number of plants per m^2, plant height (cm), number of pods per plant, weight of 1000 seeds, number of seeds per pod, incidence of insect pest and diseases and economic yield (q/ha) were taken to study its adoption ability and to estimate the economic benefits. The yield per hectare was calculated by the following formula:

$$\text{Seed yield per ha} = \frac{\text{Seed yield per plot}}{\text{Plot size } (m^2)} \times 10{,}000$$

The traditional farmer's' practices were done in case of local checks. The data in terms of technology gap, extension gap and technology index were calculated from both local checks and demonstration plots by using the formula as suggested by Samui *et al* (2000).

$$\text{Increase over local check (\%)} = \frac{\text{Demonstration yield - Local check}}{\text{Local check}} \times 100$$

Technology gap (Q/ha) = Potential yield - Demonstration yield

Extension gap (Q/ha) = Demonstration yield - Local check

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \text{ X } 100$$

Result and Discussion

Plant population, number and weight of seeds

The results depicted in Table 1 shows that number of plants/m^2 was varied from 46 to 57 with an average of 52 plants /m^2. Plant height was recorded at maturity of crop using measuring tape from bottom to tip of the randomly selected five plants in each plot and the average height of 138.78 cm was obtained with its range from 137.1- 140.7 cm. The pods of five plants were randomly selected, counted and average number of pods/plant was 99.5 with its range of 83 - 116 number of pods. One thousand seeds from the seed lot threshed from each plot were collected, weighed and the average weight of 1000 seeds was 3.46 gm with the range of 3.20-3.87 gm. At maturity, the pods from the randomly selected five plants were threshed and number of seeds in each pod was counted and average of 100.5 seeds per pod was recorded with a range of 96-112 numbers of seeds.

Table 1: Agronomic parameters of *Sesamum* cultivation on selected farms in the district Amritsar during *Kharif*, 2016

No of plants/ m^2	Plant height (cm)	No of pods/plant	Weight of 1000 seeds (g)	No of seeds/pod
57	140.7	116	3.87	112
56	140.4	104	3.40	104
54	138.9	104	3.75	104
48	137.9	83	3.20	88
53	138.2	98	3.45	98
54	139.6	103	3.50	104
48	137.5	93	3.23	96
46	137.1	95	3.35	98
Average 52	**138.78**	**99.5**	**3.46**	**100.5**

Yield: The average grain yield 5.50 q/ha was observed by the selected framers (Table 2). The grain yield was ranged from 3.75 to 7.50 q/ha and its fluctuation shows the dependency upon the weather conditions. The wider range of the yield indicates the need to reduce the yield variations at the farmers field. The average yield on the selected farms was 66.66 per cent higher as compared to the state average of *Sesamum* (3.3 q/ha). It is clear from the table that the average grain yield depends upon number of seeds per pod and number of pods per plant. The data on days to maturity showed the average crop duration which was 89.5 days in district Amritsar with a range of 85 to 97 days. The farmers applied less number of irrigations due to rains and on an average two irrigations were performed by the farmers.

The acceptance of any agricultural crop depends upon its input and output value. An average gross return of 40991 per hectare was obtained by the sample farmers (Table 2). The total variable cost per hectare for raising the crop in the field was Rs 20409. The major contribution in the cost of cultivation of *Sesamum* crop was human labour (used in production, harvesting and seed extraction), tractor use and marketing charges and cost of seed. Therefore, the return over variable costs per hectare obtained was 20582. The benefit-cost (B:C) ratio of *Sesamum* cultivation was 1.01. The area under *Sesamum* may increase in the district due to the promotion of the crop as well as higher yield returns from the new technology.

Incidence of diseases and insect pests:- The data on incidence of diseases and insect pests were also recorded and presented in Table 3. Phyllody is one of the major diseases of *Sesamum* which was observed on six out of eight farmer's field in the range of 0.25 to 2.50 per cent. The disease is caused by mycoplasma like organism (MLO) and is transmitted by *Orosius albicinctus*. Sometimes the attack of the disease is 90-100 per cent and causes total yield loss of the crop (Sarwar and Haq, 2006). The observations made on insect pest incidence revealed that pod borer incidence was in the range of 0.25 to 1.50 per cent observed at five farmer's field.

Table 2: Performance of *Sesamum* on selected farms in the district Amritsar during *Kharif,* 2016

Crop Duration (days)	IrrigationApplied (Number	Average Grain Yield (q/ha)	Gross Returns (Rs/ha)	Total Variable Costs (Rs/ha)	Returns Over Variable Costs (Rs/ha)
88	2	7.50	60000	21705	38295
85	2	6.75	48600	21088	27512
88	2	6.25	46250	21379	24871
87	2	3.75	26625	18866	7759
92	2	5.00	36000	19427	16573
93	2	6.25	46250	20845	25405
97	2	4.00	30000	19585	10415
86	2	4.50	34200	20376	13824
Average 89.5	**2**	**5.50**	**40991**	**20409**	**20582**

Table 3: Incidence of diseases and insect pests on *Sesamum* in the district Amritsar during *Kharif*, 2016

Date of sowing	Disease incidence Phyllody (%)	Insect-pest incidence Pod Borer (%)	Overall performance
10.07.2016	-	-	Good growth
09.07.2016	-	-	Good growth
10.07.2016	0.25	0.25	Good growth
12.07.2016	2.50	1.00	Affected by rain
13.07.2016	0.50	0.50	-
12.07.2016	1.00	-	Good growth
11.07.2016	2.00	1.50	Affected by rain
12.07.2016	2.50	1.50	Affected by rain

Technology gap, extension gap and technology index: The yields of front line demonstration and potential yield of the variety was compared and further categorized into technology and extension gaps (Table 4). The results indicated that use of high yielding variety, balanced application of fertilizers and management of insect pests and diseases gave average 83.96 % more yield of *sesamum* as compared to local check (2.95 q/ha). The technology gap ranged from -.0.50 to 3.25 q/ha with a mean of 1.50 q/ha. The value of the extension gap was from 1.25 to 3.75 q/ha and average value was 2.55 q/ha. Technology and extension gaps indicated the need to educate the farmers more and more for the adoption of improved variety Punjab Til No. 2. The data on technology index reduced from 46.42 to -7.14 per cent which indicated the practicability of the demonstrated technology at farmers field. The lower the value of technology index, higher is the feasibility of the technology. The findings were confirmed with the findings of Choudhary *et al.* (2009) who found that difference in improved crop management technology to be the possible reason for greater technological index in the sesame cultivars in the study area. Singh and Jat (2014) also suggested that the farmers may be educated for the improvement of the latest technologies of sesame crop through different media like training, field demonstrations and exposure visits *etc*. The farmers may also be provided the seed at reasonable rates at the village level.

Conclusion

The frontline demonstrations of *Sesamum* conducted during *Kharif*, 2016 in the district proves that average yield of 5.5 qt per hectare can be achieved in *Sesamum* cultivation with the adoption of the variety Punjab Til No. 2 recommended by PAU, Ludhiana. Due to good gross return of 40991 per hectare achieved by the sample farmers and demonstration

Table 4: Productivity, technology gap, extension gap and technology index in *Sesamum* (Punjab Til No. 2) FLDs of Amritsar District during *Kharif*, 2016

Yield (Q/ha)			Increase over local check (%)	Technology gap (Q/ha)	Extension gap Q/ha)	Technology index (%)
Potential Yield	Demonstration	Local check				
7.00	7.50	3.75	100.00	-0.50	3.75	-7.14
7.00	6.75	3.25	107.70	0.25	3.50	3.57
7.00	6.25	3.15	98.41	0.75	3.10	10.71
7.00	3.75	2.50	50.00	3.25	1.25	46.42
7.00	5.00	2.75	81.81	2.00	2.25	28.57
7.00	6.25	3.00	108.33	0.75	3.25	10.71
7.00	4.00	2.75	45.45	3.00	1.25	42.85
7.00	4.50	2.50	80.00	2.50	2.00	35.71
Mean 7.00	**5.50**	**2.95**	**83.96**	**1.50**	**2.55**	**21.42**

efforts the area under *Sesamum* may increase in the district. The improved technology of *Sesamum* cultivation has been found more productive and rewarding over the prevailing practices in the district. Therefore, there is a scope that the yield might be increased up to 66.66 per cent with the help of new technology. The cultivation of *Sesamum* can be easily fit into basmati belt of the district due to the same sowing time *i.e.* in the month of July. The results indicated that *Sesamum* technology has given a good impact as the farmers were motivated by recommended technology which was applied in the fields of frontline demonstrations. The demonstrated technology recorded grain yield 5.50 q/ha which is 83.96 per cent higher yield than local check variety. It was also observed that the productivity of *Sesamum* can be doubled with the help of available advanced technology. To promote the cultivation of *Sesamum* good quality seed of the recommended varieties along with the timely dissemination of the new technology is required. So, Front line demonstrations were useful in creating awareness among the farmers for diversions of the areas towards oilseed crops. A need was also observed to improve the yield stability of the *Sesamum* crop.

Paper received on : January 13, 2018
Accepted on : January 27, 2018

REFERENCES

Anon (2016). India: Oilseeds - Area, Production and Productivity http://www.sopa.org/india-oilseeds-area-production-and-productivity/

Anon (2017). *Package of practices for the crops of Punjab, Kharif, 2017*. 34: 107.

Choudhary, A. K., Yadav, D. S, & Singh, A. (2009). Technological and extension yield gaps in oilseeds in Mandi district of Himachal Pradesh. *Indian Journal of Soil Conservation,* 37(3), 224-229.

Hansen, R. (2011). Sesame. AgMRC, Iowa State University, USA. http://www.agmrc.org / commodities-products/grains-oilseeds/sesame-profile/

Hintsa, M., Fantaye, B., & Atsbha, G. (2015). Demonstration of Improved Sesame Varieties (*Sesamum indicum* L.) with Improved Production Technologies on Small Scale Farms at Qola Tebmien and Tanqua Abergelle Destrict, Ethiopia. *Innovative Systems Design and Engineering,* 6(12), 15-18.

Jha, G.K., Pal, S., Mathur, V.C., Bisaria, G., Anbukkani, P., Burman, R.R., & Dubey, S.K. (2012). Edible Oilseeds Supply and Demand Scenario in India: Implications for Policy. Indian Agricultural Research Institute Publication, pp. 5-15.

Khaleque, M. A., & Begum, D. (1991). Area and production of Oilseed crops, 1988-90. In fifteen years of oilseed research and development in Bangladesh. AST/CIDA 28:190.

Samui, S.K., Maitra, S., Roy, D. K., Mondal A. K., & Saha, D. (2000). Evaluation on front line demonstration on groundnut (*Arachis hypogea* L.). *Journal of Indian Society Coastal Agricultural Research,* 18, 180-183.

Sarwar, G., & Haq, M.A. (2006). Evaluation of *Sesamum* germplasm for genetic parameters and disease resistance. *J. Agric. Res.* 44(2), 89-95.

Singh, H., & Jat, J.R. (2014). Constraints faced by the farmers in adoption of improved technologies of sesame crop in Jodhpur district of Rajasthan. *International Journal of Extension Education and Research Development,* 22 190-191.

Toan, D. P., Thuy-Duong, T.N.A., Carlsson, S., & Bui, T.M. (2010) Morphological Evaluation of Sesame (*Sesamum indicum* L.) Varieties from different origins. *Australian Journal of Crop Science*, 4, 498-504.