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Impact of Improved Technologies on Productivity Enhancement of Sesame (*Sesamum indicum* L.)

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ABSTARCT: Sesame (*Sesamum indicum* L.) is one of the important oilseed crops in India. The major constraint of its low productivity is non-adoption of improved technologies by the farmers. Frontline demonstrations were conducted at 45 farmers' field during 2011, 2012 and 2013, to demonstrate production potential and economic benefit of improved technologies comprising sowing method, nutrient management and chemical weed control and adoption of whole package of practices for the crop. Pre-emergence application (within two days of sowing) of weedicide Lasso 50 EC (Alachlor) at 3 litres/ha in 500 litres of water used for effective control of the weeds during *kharif* season in rainfed condition. The technologies improved the yield attributing traits as well as seed yield of the crop. The improved technology recorded a mean yield of 468 kg/ha which was 32% higher than that obtained with farmers' practice (355 kg/ha). Higher mean net income of ₹ 31,391/ha with a benefit: cost ratio of 2.65 was obtained with improved technologies in comparison to farmers' practice (₹ 23,323/ha, 2.37).

Key words: Sesame, productivity, frontline demonstration, improved technology, farmers' practice, net return

Sesame (*Sesamum indicum*) commonly known as til (Hindi) is an ancient oilseed crop of India. The crop is now grown in a wide range of environments, extending from semi-arid tropics and subtropics to temperate regions. Therefore, the crop has a large diversity in cultivars and cultural systems. India ranks first in the world in terms of sesame-growing area (23%) and second largest producer of sesame in the world after Myanmar. But the productivity is only 335.16 kg/ha (FAO, 2012) which is lower than most of the sesame growing countries. This probably indicates a great opportunity for a higher increase in sesame productivity in India. The potential yield of sesame is much higher than actual yield, as much damage occurs by pests and diseases, insufficient weed control, high levels of monocropping, lack of mechanisation and unrealised genetic potential. Potential yields are probably as high as 2000 kg/ha (Mkamilo and Bedigian, 2007).

It is called as 'queen' of oilseeds by virtue of its excellent oil quality. Its seeds are eaten fried, mixed with sugar. Sesame oil is used as cooking oil in southern India. It is also used for anointing the body, for manufacturing perfumed oils and for medicinal purposes. It is having the highest oil content (46-64%) and dietary energy (6355 kcal/kg). Its oil unlike other fats is highly stable and does not develop rancidity leading to loss of flavour and vitamin. Sesame cake is a rich source of protein, carbohydrates and minerals, such as calcium and phosphorus. The cake is edible and is eaten widely by working classes. It is also a valuable and nutritious feed for milch cattle. The oil is highly resistant to oxidative rancidity and exerts synergistic effect on the action of certain insecticides like pyrethrins and rotenone.

In general, average productivity of sesame continues to be lower than expected from agricultural technology for the last 40 years, mainly due to its cultivation on marginal lands, poor management practices and low input application except seed. The major constraint responsible for lower yield is adoption of inappropriate production technologies by farmers viz., broadcast method of sowing, no use of fertilizer and untimely or poor weed management (Khaleque and Begum, 1991). The yield of sesame can be increased substantially with adoption of improved technologies such as improved variety, recommended dose of fertilizer, weed management and plant protection. Keeping this in view, frontline demonstrations (on farmer's fields) on sesame were conducted to demonstrate the production potential and economic benefits of latest improved technologies to the farmers.

Materials and Methods

In total 45 front line demonstrations were conducted on farmers' fields in villages viz; Naude Majra, Rajgiri, Jhandian, Jatawar, Dhamana (Distt. Rupnagar), Nainwan (Distt. Hoshiarpur) & Thanawal, Takarla, Thopia, Saunkhri, Ballowal, Ratewal (Distt. SBS Nagar) of Punjab, during kharif seasons of 2011, 2012 & 2013 in rainfed condition, on light to medium soil with low to medium fertility status under sesame-taramira/raya/wheat production system. Each demonstration was conducted on an area of 0.4 ha, and 0.1 ha area adjacent to the demonstration plot was kept as farmers' practice. The package of improved technologies like line sowing, nutrient management, chemical weed management and whole package were used in the demonstrations. The variety of sesame RT 346 was included in demonstrations. Methods used for the present study with respect to FLDs and farmers' practices are given in Table 1. In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were sandy loam to loamy sand and medium to low in fertility status. The spacing was 30 cm between rows and 10 cm between plants in the rows. The thinning and weeding was done invariably 30-35 days after sowing to ensure recommended plant spacing within a row because excess population adversely affects growth and yield of crop. Seed sowing was done in the second fortnight of

Table 1 : Particulars showing the details of sesame grown under FLD and farmers' practice

Operation	Existing practice	Improved practices demonstrated
Line sowing	Broadcasting of seed	Spacing: 30 cm between rows and 10 cm between plants in the row.
Weed management	No weed management	Weeds control by using herbicide Lasso 50 EC (Alachlor) at 3 litres/ha in 500 litre of water as pre-emergence treatment for effective control of weeds within two days of sowing. The thinning and weeding was done invariably 30-35 days after sowing to ensure recommended plant spacing within a row.
Nutrient management	Only FYM and no fertilizer application	10 tonnes/ha farm yard manure and 35 kg N/ha.
Whole package	Farmers are cultivating the sesame crop without adoption of any improved technology	All the crop (production and protection) management practices as per the package of practices for *kharif* crops by Punjab Agricultural University, Ludhiana were followed for raising the crop.

July with a seed rate of 2.5 kg/ha. Other management practices were applied as per the package of practices for *kharif* crops by Punjab Agricultural University, Ludhiana (Anonymous, 2011). The crop was harvested in the month of October after the leaves turn yellow and start dropping while the capsules are still greenish- yellow.

Results and Discussion

Yield attributing traits

The number of productive capsule per plant under improved technology were 47.8, 42.4 & 49.0 as against local check (farmers' practice), 36.6, 33.8 & 36.0 (Table 2) during the year 2011, 2012 & 2013, respectively. There was an increase of 30.6, 25.4 & 36.1% in number of productive capsules under demonstration of improved technology over farmers' practice. The average number of productive capsules per plant was 46.4 under improved technology and 35.5 under farmers' practice, thus there were 30.7% more capsules per plant under improved technology demonstrations.

The average number of seeds per capsule in improved technology was 74.4 as compared to 70.6 in farmers' practice. The number of seeds per capsule under improved technology and farmers' practice were 74.6, 72.2 & 76.4 and 71.0, 68.8 & 72.0 during the year 2011, 2012 & 2013, respectively. The percentage increase in seeds per capsule during the three years was 5.1, 4.9 & 6.1, respectively with an average of 5.4 seeds per capsule.

Test weight (g/1000 seed) observation showed that during 2011, 2012 & 2013 the test weight under improved technology and local check were 2.83, 2.64 & 2.95 and 2.25, 2.18 & 2.20, respectively with an average test weight of 2.81 under improved technology and 2.21 under farmers' practice. The per cent increase in test weight during three years was 25.8, 21.1 & 34.1 with an average of 27.0 over the years.

Seed yield (kg/ha)

The productivity of sesame under improved production technology ranged between 342 and 650 kg/ha with mean yield of 468 kg/ha (Table 3). The productivity under improved technology varied from 342 to 538, 375 to 500 & 394 to 650 kg/ha with a mean yield of 439, 449 & 516 kg/ha during 2011, 2012 & 2013, respectively as against a yield range between 328 to 363 kg/ha with a mean of 355 kg/ha under farmers' practice. The additional yield under improved technologies over farmers' practice ranged from 64 to 153 kg/ha with a mean of 113 kg/ha. In comparison to farmer's practice, there was an increase of 17, 37 and 42% in productivity of sesame under improved technologies in 2011, 2012 & 2013, respectively. The increased grain yield with improved technologies was mainly because of line sowing, use of nutrient management and weed management.

Fertilizer response has been widely studied in other countries and the extent of the response depends on many factors: with high yielding varieties higher fertiliser rates are needed and also in cases of lower soil fertility (Tripathi and Rajput, 2007). Adoption of Improved technology increased sesame yield by 34% as compared to farmers' practice (Rajkwar and Srivastva, 2013). Higher weed infestation under farmers' practice as evident from the higher weed cover and reduced supply of nutrients and water under farmers' practice led to lower yield. The results corroborate with the findings of Imoloame *et al*. (2007) and Stonebridge (1963) who reported the superiority of row planting over broadcasting to control weed, which resulted in considerable yield increase.

Economics

The economic viability of improved technologies over traditional farmer's practice was calculated depending on prevailing prices of inputs and output costs (Table 4). It was found that cost of production of sesame under improved technology varied from ₹ 12,588 to 14,453/ha as against ₹ 10,706 to 12,568/ha under farmers' practice. The improved technologies registered an additional cost of production ranging from ₹ 3,116 to 12,041/ha over farmers' practice. The additional cost incurred in the improved technologies was mainly due to more cost involved in balanced fertilizer, improved seed and weed management practices. Cultivation of sesame under improved technologies gave higher net return which ranged from ₹ 23,297 to 37,195/ha as compared to farmers' practice which recorded ₹ 20,181 to 25,154/ha. Similar results have been reported by Khan *et al*. (2009) and Raikwar & Srivastva (2013). The improved technologies also gave higher benefit cost ratio of 1.70, 2.67 and 3.57 as compared to 1.57, 2.28 and 3.25 under farmers' practice in the corresponding season.

Table 2 : Yield attributing traits of sesame

Year	Yield attributing characters								
	Number of productive capsules/plant			Number of seeds/Capsule			Test weight (gm)		
	Improved Technology (IT)	Farmers' practice (FP)	% increase	Improved Technology (IT)	Farmers' practice (FP)	% increase	Improved Technology (IT)	Farmers' practice (FP)	% increase
2011	47.8	36.6	30.6	74.6	71.0	5.1	2.83	2.25	25.8
2012	42.4	33.8	25.4	72.2	68.8	4.9	2.64	2.18	21.1
2013	49.0	36.0	36.1	76.4	72.0	6.1	2.95	2.20	34.1
Average	46.4	35.5	30.7	74.4	70.6	5.4	2.81	2.21	27.0

Table 3 : Seed yield of sesame as affected by improved and farmer practices in farmer fields

Year	Area (ha)	Demonstration (No.)	Yield (kg/ha)			Farmers' practice (FP)	Additional yield (kg/ha) over farmers' practice	% increase in yield over farmers' practice
			Improved Technology (IT)					
			Maximum	Minimum	Average			
2011	2.0	4	538	342	439	375	64	17
2012	8.0	16	500	375	449	328	121	37
2013	12.5	25	650	394	516	363	153	42
Average	7.5	15	563	370	468	355	113	32

Table 4 : Cost of cultivation (₹/ha), net return (₹/ha) and benefit: cost-ratio of sesame as affected by improved and farmers' practice

Year	Cost of cultivation (₹/ha)		Net returns (₹/ha)		Additional cost of cultivation (₹/ha)	Additional net returns (₹/ha)	B-C ratio	
	IT	FP	IT	FP			IT	FP
2011	13,578	12,568	23,297	20,181	802	3,116	1.70	1.57
2012	12,588	10,706	33,680	24,633	1,882	9,047	2.67	2.28
2013	14,453	11,186	37,195	25,154	3,267	12,041	3.57	3.25
Average	13,540	11,487	31,391	23,323	1,984	8,068	2.65	2.37

Sale price of sesame: ₹ 85/kg (2011), ₹ 100/kg (2012) and ₹ 100/kg (2013)

Conclusion

The frontline demonstrations conducted on sesame at the farmers' field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of the crop and also the net returns to the farmers. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers' should be encouraged to adopt the recommended package of practices realizing for higher returns.

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References

Anonymous. 2011. *Package of Practices for crops of Punjab - Kharif*. Punjab Agricultural University, Ludhiana, Punjab, India. FAO. 2012. FAO Agricultural Production Statistics, http://faostat.fao.org/ as accessed on 23 February 2014.

Imoloame EO, Gworgwor NA and Joshua SD. 2007. Sesame (*Sesamum indicum* L.) weed infestation, yield and yield components as influenced by sowing method and seed rate in Sudan Savanna agro-ecology of Nigeria. African Journal of Agricultural Research. 2(10): 528-533.

Khaleque MA and 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.

Khan MAH, Sultana NA, Islam MN and Hasanuzzaman M. 2009. Yield and yield contributing of Sesame as affected by different management practices. American-Eurasian Journal of Scientific Research. 4(3): 195-197.

Mkamilo GS and Bedigian D. 2007. *Sesamum indicum* L. In H.A.M. van der Vossen and G.S. Mkamilo, (Eds.). Vegetable Oils. Plant Resources of Tropical Africa [PROTA] Vol. 14: 153-158. PROTA Programme, Wageningen University, the Netherlands. http://database.prota.org/PROTAhtml/Ceratotheca%20sesamoides_En.htm

Raikwar RS and Srivastva P. 2013. Productivity enhancement of sesame (Sesamum indicum L.) through improved production technologies. African Journal of Agricultural Research. 8(47): 6073-6078.

Stonebridge WC. 1963. Benniseed variety and sowing method trails. Technical Report of Institute for Agricultural Research, Northern Nigeria 28:1-9.

Tripathi ML and Rajput RL. 2007. Response of sesame (*Sesamum indicum*) genotypes to levels of fertilizers. Advances in Plant Sciences. 20: 521-522.

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