Research Article

Indian Journal of Extension Education
Vol. 59, No. 2 (April–June), 2023, (55-60)

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

Yield Gaps and Scaling up of Sesame Variety (RT-351) in Potential Areas of Rajasthan

M. S. Meena[1]*, S. K. Singh[2], H. N. Meena[3] and R. Bishnoi[4]

[1]Principal Scientist (Agricultural Extension), [2]Director, [3]Senior Scientist (Agronomy), [4] Senior Research Fellow, NFSM-Oilseeds, ICAR-ATARI, Zone-II, ICAR-ATARI, Zone-II, Jodhpur, Rajasthan, India

*Corresponding author email id: mohar.meena@icar.gov.in

ARTICLE INFO

Keywords: Sesame, RT-351, Scaling up, Technology gap, Cluster front line demonstrations, Extension gap

http://doi.org/10.48165/IJEE.2023.59212

Conflict of Interest: None

ABSTRACT

The study evaluates the cluster front line demonstrations (CFLDs) conducted under the national food security mission on sesame (RT-351) by 26 KVKs of Rajasthan state. Four thousand one (4001) partner farmers responded to the study during 2016-2020. The CFLDs were undertaken in a 172.00 ha area in 26 districts during these five years. Yield gaps and technology index were calculated under the study. The result shows an extension gap of 1.35 q ha^{-1} and a technology gap of 2.78 q ha^{-1}. The technology index was found to be 35.11 per cent, while a yield advantage of 36.17 per cent was found in CFLDs. KVKs of Rajasthan state could add Rs. 1.45 crores to the income of partner farmers. The improved variety & better extension services significantly enhanced production and productivity. Participatory approaches in the sesame seed supply chain and institutional linkage were critical for scaling up sustainable technology and improving farmers' access to quality and sufficiently improved seeds. More capsules per plant and resistance to stem & root rot attracted the farmers. Technical backstopping, supplying of seed, and seed exchange through farmer-to-farmer extension were crucial on a sustainable basis. Regular monitoring by experts and farmers' feedback is vital for sustained production and productivity improvement of the sesame crop.

INTRODUCTION

After cereals, oilseeds are the world's second-most important crop in India, accounting for 15.7 per cent of the gross cultivated area and 11 per cent of the total agricultural output value (Sri et al., 2022; Anonymous, 2020a; Singh et al., 2020). Globally, India, Myanmar, and China are the highest producers of sesame. In 2018 (6,016,000 MT) sesame was grown on 11,743,000 ha, yielding an average of 512 kg/ha. India is the second country where the cultivated area is 1.73 million hectares, producing 0.74 million tonnes (third rank) and contributing 12.4 per cent of global sesame production with an average yield of 431 kg ha^{-1} (FAOSTAT, 2020). Globally, sesame seed consumption was USD 6559.0 million in 2018, expected to touch USD 7244.9 million by 2024, with a compound annual growth rate (CAGR) of 1.7 per cent (Myint et al., 2020). Among the sesame-growing states in India, Gujarat is the leading state contributing 22.3 per cent, followed by West Bengal (19.2%), Karnataka (13.5%), Rajasthan (9.8%), and Madhya Pradesh (MP) (9.06%). Ranganatha et al., (2013) estimated the yield gap-I (between improved technology and farmers' practices) ranged from 23.5 per cent in Rajasthan to 72.1 per cent in Uttar Pradesh (UP). If the yield gap was bridged, the national sesame production could be increased to 1145.4 thousand tonnes from 785.6 thousand tonnes. Similarly, the yield gap-II (between improved technology and average state productivity) ranged from 5.9 per cent in Karnataka to 775.1 per cent in UP. The national sesame production could be increased to 2097.6 thousand tonnes from 1145.4 thousand tonnes by bridging the yield gap II. Alike oilseeds, in pulses technology gap is observed more than extension gap at farmers field (Kumbhare et al., 2014; Nain et al., 2014; Nain

Received 06-02-2023; Accepted 15-03-2023

et al., 2015). Kushahwah et al., (2018) reported that the average yield gap in sesame production technology was from 0.5 to 2.0 q ha^{-1} in MP. Under CFLDs, the additional net return of Rs. 7669 was observed.

The CFLDs were found very useful in increasing farmers' knowledge and adoption levels. These CFLDs created greater awareness and motivated the farmers to adopt appropriate oilseed production technologies (Patil et al., 2018 & 2019). However, the improved variety could not reach many farmers due to casual field extension approaches and farmers do not consider sesame a major crop and lack of access to improved seeds. As a result, the production and productivity of sesame in Rajasthan are very low and the farmers do not get the potential benefit. Therefore, this research initiated a demand-driven approach and linkage among the concerned stakeholders in order to enhance the adoption and dissemination of the RT-351 variety. To enhance sesame production, the Government of India has devised a scheme to encourage sesame production by conducting CFLDs on oilseeds under the national food security mission (NFSM). The present study conducts and evaluates the performance of CFLDs on sesame laid out in 26 districts of Rajasthan state from 2016 to 2020.

METHODOLOGY

The present study evaluates the performance of CFLDs on sesame which were conducted under the supervision of the agricultural scientists of ICAR-ATARI, Zone-II, Jodhpur, and officials of the Ministry of Agriculture and Farmers Welfare, New Delhi. The CFLDs were laid out in 26 districts of Rajasthan state from the year 2016 to 2020. Data were solicited from 4001 partner farmers in the participatory mode. The variety used in this participatory research was RT-351, which was recommended for the state. The agronomic practices for implementing the research were 30 cm and 15 cm between row and plant, respectively. A 2.0 to 2.5 kg seed rate and fertilizers at 40 kg Nitrogen, 25 kg Phosphorus, and 20 kg Sulphur per hectare were applied. Critical inputs like seed, bio-fertilizers, etc., costing up to Rs. 5000 per ha, were provided by KVKs. Institutional linkage among the diverse actors and strong information exchange between all stakeholders leads to effective technology scaling up. The scaling-up activity was adopted from Linn et al., (2010). The KVK scientists were engaged in selecting partner farmers, site selection, clustering for demonstrations, sowing, organizing field days, interaction for feedback, and other critical stages. The training on a package of practices of RT-351 for partner farmers was given by KVKs. Field days at farmers' fields were arranged to create informal contact for two-way communication, learning and feedback on the technology demonstrated.

RESULTS AND DISCUSSION

The scaling-up activity was adopted from Linn et al., (2010). The conceptual framework of scaling up activity is presented in Figure 1. It involves three phases. In innovation phase, testing, verification, and validation of sesame technologies were done and covered the previously implemented research experiments and participatory evaluation of improved sesame varieties i.e., RT-351 which had a yield advantage of up to 801 kg ha^{-1} compared to the local cultivars. The RT-351 variety is recommended based on its high yield performance and resistance to macrophomina stem and root rot, leaf curl, and phyllody. The demonstrations are a critical tool for extension promotion allowing the farmers to evaluate, test, and learn about the new technologies (Mbure & Clare, 2017). Farmers are more likely to test the new technology with higher expected benefits and relatively lower risks (Pannell et al., 2006). During the learning phase, farmers learned by observing the

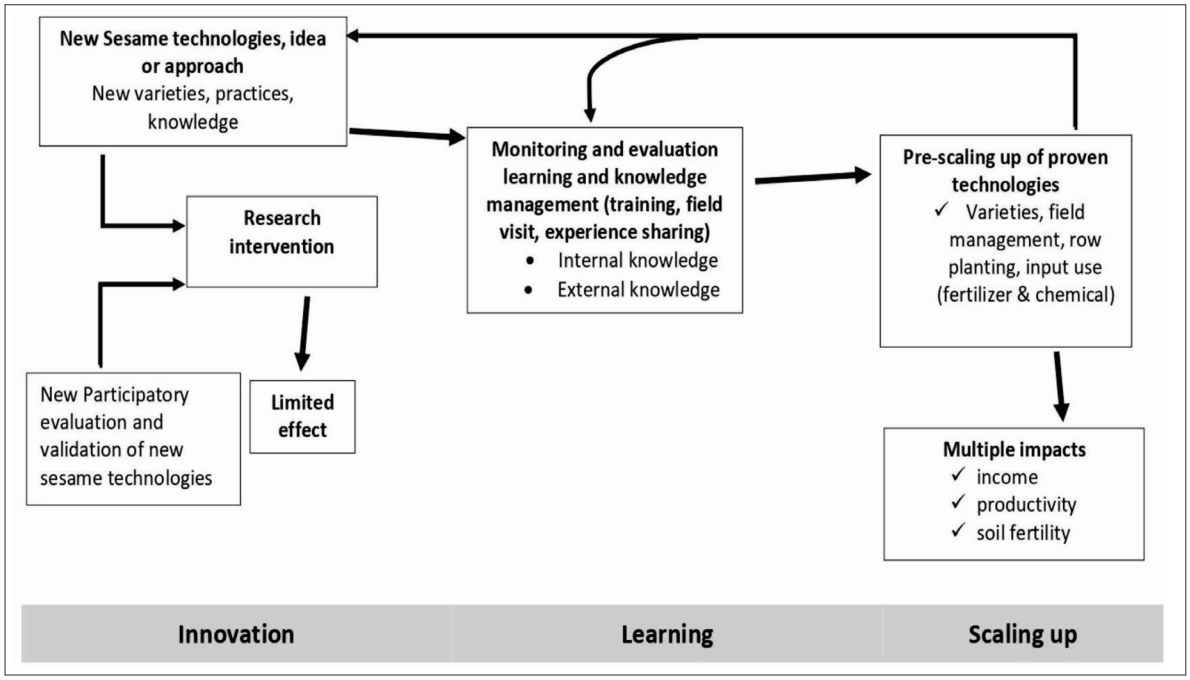

Figure 1. Conceptual framework of the scaling-up activity
Source: Adopted from Linn et al., (2010)

demonstration plots, and group dynamics taught each other. The farmers and other actors were capacitated through training and field visits and contributed by forwarding their feedback. The innovations or technologies demonstrated and tested during the innovation and learning phases were brought to a large scale-up in the scaling-up phase. The results of the study have been presented in the sub-headings as given below.

Capacity building and demonstration of improved variety of sesame

Capacity building of various stakeholders is vital in transferring innovations among the farming community through the extension systems. New technologies' adoption and diffusion rate increased when farmers' and extension personnel' knowledge, skill, and attitudes changed. For capacity building of KVK scientific staff, training/workshops on oilseed production technology were organized each year (2016-2020) by ICAR-ATARI, Jodhpur. Before implementing the activity, training was organized in each district for farmers on the full production package of the improved sesame variety. A total of 4001 farmers were trained in sesame agronomical production and seed production during the implementation period. Farmer's attitudes and opinions towards the introduced improved variety of sesame, seed production, and marketing were remarkably changed due to continuous training; field monitoring, partnership strength, market linkage and access to improved seed, and experiences of production and marketing activities. An improved variety of the sesame (RT-351) variety was used for the pre-scaling up based on farmers' preferences. A total of 4.3 tons of improved seeds were demonstrated during implementation, and more than 1721 ha of land were covered. Most importantly, the technology was spread over sesame production potential areas through a farmer-to-farmer seed exchange. As a result, many farmers benefited from easy access to improved seeds through direct seed marketing, farmer-to-farmer seed exchange systems, and revolving seed. As traced back from each district's agriculture office, more than 83.00 ha of the area was covered with improved variety of sesame (RT-351) seed during the implementation period through farmer-to-farmer seed exchange systems.

Yield advantage of growing improved variety of sesame

Table 1 depicts the yields of sesame in the various districts of Rajasthan. The average productivity of sesame in the

Table 1. Yield increased & gap minimized in sesame in Rajasthan, India (n=4001)

S.N.	KVKs	Number of CFLDs	Yield gap minimized (q/ha)							
			Farmers' practices (q ha^{-1})	CFLDs (q ha^{-1})	Potential (q ha^{-1})	Yield increase (CFLDs-FP) (q ha^{-1})	Yield increase (%)	Extension gap (q ha^{-1}) {CFLD-FP q ha^{-1}}	Technology gap (q ha^{-1}) {potential-CFLD q ha^{-1}}	Technology index (%)
1.	Ajmer	220	4.53	6.96	8.00	2.43	53.47	2.43	1.04	13.00
2.	Alwar-I	70	3.42	4.77	8.00	1.35	39.47	1.35	3.23	40.37
3.	Alwar-II	58	2.42	2.92	8.00	0.50	20.66	0.50	5.08	63.50
4.	Barmer-II	40	2.10	2.87	7.00	0.77	36.67	0.77	4.13	59.00
5.	Baran	115	4.25	4.85	8.00	0.60	14.05	0.60	3.15	39.37
6.	Bharatpur	219	4.29	4.94	8.00	0.65	15.01	0.65	3.06	38.25
7.	Bhilwara-I	125	4.24	5.75	8.00	1.51	35.57	1.51	2.25	28.12
8.	Bhilwara II	75	4.85	6.35	8.00	1.50	30.93	1.50	1.65	20.62
9.	Churu-I	150	3.18	4.56	8.00	1.38	43.25	1.38	3.44	43.00
10.	Dholpur	411	6.27	8.01	8.00	1.74	27.66	1.74	-0.01	-0.12
11.	Jaipur-I	297	4.40	6.04	8.00	1.64	37.22	1.64	1.96	24.50
12.	Jaisalmer-I	63	2.69	3.62	8.00	0.94	34.85	0.94	4.38	54.75
13.	Jaisalmer-II	25	2.87	3.92	8.00	1.05	36.59	1.05	4.08	51.00
14.	Jalore	140	4.80	6.53	8.00	1.73	36.04	1.73	1.47	18.37
15.	Jodhpur-I	225	3.37	4.84	8.06	1.47	43.59	1.47	3.22	39.96
16.	Jodhpur-II	50	3.48	3.95	8.00	0.47	13.51	0.47	4.05	50.62
17.	Karauli	325	5.13	6.12	8.00	0.99	19.17	0.99	1.88	23.50
18.	Nagaur-I	110	3.30	4.39	8.00	1.09	33.00	1.09	3.61	45.12
19.	Nagaur-II	150	3.34	4.27	8.00	0.94	28.14	0.94	3.73	46.62
20.	Pali	285	3.57	4.86	8.00	1.29	36.05	1.29	3.14	39.25
21.	Rajsamand	166	3.77	5.13	8.00	1.37	36.18	1.37	2.87	35.87
22.	Sawaimadhopur	200	4.36	6.20	8.00	1.85	42.32	1.85	1.80	22.50
23.	Sirohi	275	4.29	5.70	8.00	1.41	32.74	1.41	2.30	28.75
24.	Sriganganagar	25	3.61	6.90	8.00	3.29	91.14	3.29	1.10	13.75
25.	Tonk	107	4.60	7.05	8.00	2.45	53.26	2.45	0.95	11.87
26.	Ajmer	75	2.51	3.09	8.00	0.58	23.16	0.58	4.91	61.37
	Total	4001	-	-	-	-	-	-	-	-
	Average	-	3.83	5.18	7.96	1.35	36.17	1.35	2.78	35.11

Source: Primary data collected from 2016 to 2020

Table 2. Economics of CFLDs on sesame (RT-351) in Rajasthan, India (n=4001)

S.N.	KVKs	Area (ha)	CFLDs	Economics of FP (Rs/ha)				Economics of CFLDs (Rs/ha)				Total income enhancement (Rs.)
				Gross cost	Gross return	Net return	B:C ratio	Gross cost	Gross return	Net return	B:C ratio	
1.	Ajmer	110.00	220	17442.50	44688.92	27246.42	2.60	20367.00	62603.49	42236.49	3.09	1,855,942.00
2.	Alwar-I	30.00	70	12350.00	37620.00	25270.00	3.05	12800.00	52470.00	39670.00	4.10	432,000.00
3.	Alwar-II	30.00	58	19208.00	20570.00	1362.00	1.07	20625.00	24787.76	4162.76	1.20	84,022.80
4.	Barmer-II	30.00	40	13980.00	18900.00	4920.00	1.35	16225.00	25830.00	9605.00	1.59	140,550.00
5.	Baran	60.00	115	18593.00	28035.00	9442.00	1.42	19658.00	32303.00	12657.25	1.58	192,915.00
6.	Bharatpur	87.60	219	17666.67	24737.83	7071.17	1.41	19500.00	30696.58	11196.58	1.58	338,984.10
7.	Bhilwara-I	50.00	125	9500.00	32454.16	22954.00	3.42	11450.00	43969.50	17519.50	3.84	499,940.00
8.	Bhilwara II	30.00	75	10050.00	30313.00	19813.00	3.02	11650.00	41290.25	29641.00	3.54	294,840.00
9.	Churu-I	60.00	150	13876.00	33429.25	19553.25	2.33	15021.75	49009.25	33987.50	3.26	895,030.00
10.	Dholpur	170.00	411	14367.50	36165.75	21798.25	2.51	15604.00	46214.48	30610.48	3.00	1,412,945.54
11.	Jaipur-I	118.80	297	14919.00	28409.78	13490.78	1.90	17283.00	39193.04	21910.04	2.24	1,053,635.20
12.	Jaisalmer-I	30.00	63	11225.00	17665.00	6440.00	1.57	13480.00	23843.75	10363.75	1.77	110,155.00
13.	Jaisalmer-II	10.00	25	13450.00	19674.00	6224.00	1.46	15560.00	26872.00	11312.00	1.73	50,880.00
14.	Jalore	80.00	140	14633.33	31429.17	16302.67	2.15	15866.67	42752.00	26885.17	2.69	915,325.00
15.	Jodhpur-I	90.00	225	8827.50	23214.75	14387.25	2.66	9802.50	32007.50	22205.00	3.36	813,540.00
16.	Jodhpur-II	20.00	50	13320.00	27403.50	14083.50	2.10	15234.50	36681.00	21446.50	2.40	147,260.00
17.	Karauli	130.00	325	16887.25	44993.75	28106.50	2.83	17782.25	53051.25	35269.00	3.15	933,900.00
18.	Nagaur-I	50.00	110	11458.33	21761.38	10303.04	1.87	12936.67	28938.26	16001.59	2.20	254,688.30
19.	Nagaur-II	60.00	150	15977.78	21426.87	7401.25	1.34	17299.56	27839.48	10539.92	1.61	336,153.40
20.	Pali	130.00	285	12200.00	26613.47	14413.47	2.35	12739.52	33182.68	20443.17	2.77	782,255.00
21.	Rajsamand	70.00	166	9125.00	31298.75	22173.75	3.47	10625.00	42444.75	31819.75	4.13	713,360.00
22.	SawaiMadhopur	80.00	200	11542.50	28934.00	17401.00	2.00	12338.00	39258.50	26920.50	2.72	823,050.00
23.	Sirohi	110.00	275	15115.58	27201.02	12085.19	1.61	16676.33	35287.21	18610.96	1.89	734,093.00
24.	Sriganganagar	10.00	25	24240.00	40375.95	16135.95	1.67	25260.40	47847.90	22587.50	1.89	64,515.50
25.	Tonk	44.80	107	12450.00	39575.00	27125.00	3.17	14650.00	51175.00	36525.00	3.49	419,680.00
26.	Ajmer	30.00	75	5650.00	9625.00	3975.00	1.66	7250.00	19300.00	12050.00	2.66	245,500.00
	Total	1721.20	4001.00	-	-	-	-	-	-	-	-	14,545,159.84
	Average	-	-	13771.34	28712.13	14979.94	2.15	15,295.58	8,032.64	22,160.63	2.60	-

Source: Primary data collected from 2016 to 2020

demonstration fields was higher than the farmers' methods. Rai et al., (2012) found an average yield of CFLDs as 4.70 q ha^{-1}, which was 1.01 q ha^{-1} higher than the check (3.69 q ha^{-1}). Tripathi & Singh (2012) also reported a 17 per cent more yield of sesame i.e., 4.10 q ha^{-1}, which was 0.88 q ha^{-1} higher than farmer's practices (3.22 q ha^{-1}). Singh et al., (2019) observed an average yield of CFLDs on sesame as 5.65 q ha^{-1}, which was 1.75 q ha^{-1} higher than the check (3.90 q ha^{-1}). He also found an extension gap of 1.75 q ha^{-1}. Meena et al., (2017) recorded an average yield under CFLDs as 6.63 q ha^{-1}, which was 1.95 q ha^{-1} higher than farmer's practice (4.68 q ha^{-1}). During 2017 to 2018, an enchantment of 2.0 q ha^{-1} was observed where the average yield was 6.98 q ha^{-1} (Meena et al., 2018). The highest yield (8.01 q ha^{-1}) was found in Dholpur under the CFLD. The rationale behind the high productivity may be attributed to the good soil and water availability, especially during capsule formation; therefore, it exceeded the potential yield of 8 q ha^{-1}. The lowest yield was (2.87 q ha^{-1}) recorded in Barmer-II; only the Barmer district demonstrated the RT-346 variety in the Kharif 2020 season due to adverse conditions. Under the farmers' practices yields ranged from 2.10 q ha^{-1} (Barmer-II) to 6.28 q ha^{-1} (Dholpur). Overall, an average increase in grain yield of sesame under the CFLD was noticed as 1.34 q ha^{-1}. During the five years, the yield was 36.17 per cent higher than the farmers' yield. Rai et al., (2012) reported a higher yield of 1.01 q ha^{-1} through FLDs, while mass-scale adoption of sesame production technology increased the farmers' satisfaction and knowledge level.

Improving economic performances of sesame through CFLDs

Table 2 depicts the economic performance of sesame crop under CFLDs. The economic analysis indicated that sesame had a better net return from recommended practice over five years. Recommended techniques yielded a higher net return (Rs. 22160.63/ha) and average benefit-cost ratio for sesame (1:2.60), respectively as compared to the farmers' practices (Rs. 14979.94/ha and 1:2.15, respectively). The higher net returns and B:C ratio in the sesame demonstration might be due to the higher grain yield and better market pricing. During these five years, a total of 4001 CFLDs were conducted by KVKs in a 1721.20 ha area in the state. These CFLDs were added to Rs.1.45 crores as an additional income in the state economy (Figure 2).

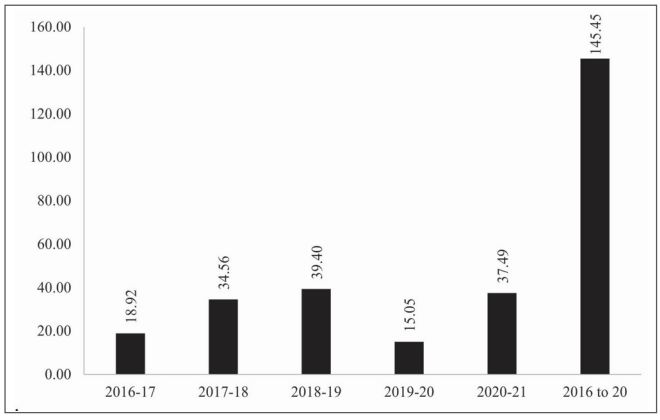

Figure 2. Income enrichment through CFLDs in Sesame, Rajasthan, India (lakhs)

Extension advisories, facilitating policies and constraints

Field day is one of the pre-scaling-up activities for the technology and it is vital in creating demand and promoting technologies to farmers and other stakeholders for getting feedback. The KVK's scientists organized the field days, subject matter specialists, and farmers at the demonstration sites; which include field visits, experience sharing, and detailed discussions on the demonstrated technologies. During the field visits, farmers explained that they were growing sesame because it holds the key as a potential rotational crop, edible oil, and high market value. Most farmers were interested and happy with the variety of sesame (RT-351) for its higher yield than their local variety. This variety has white and bold seeded and multi capsules per plant. Experts confirmed that the variety is suitable for Rajasthan and has good performance. The future of the sesame seed market is unpredictable because of the heavy rainfalls and frequent droughts in Rajasthan. The government of India is also encouraging farmers to grow sesame by increasing the MSP rate every year. During 2016-17, the MSP of the sesame crop was Rs. 5000/q and in 2020-2021, the MSP was Rs. 6855/q. Moreover, it is evident from the Figure 3. It is proven that sesame grain has high nutritive values; hence farmers use it to grow sesame. The sesame seed can be made available to other farmers under the informal seed system. Out of the total production, 3.61 per cent of produce is kept for home consumption and nearly 11.16 per cent of farmers have stored it as seeds for the next season and also promoted the farmer-to-farmer exchange for this variety of sesame (computed by authors based on KVK's feedback) and remaining product (85.23%) was sold out immediately after harvesting. Most farmers must sell their produce above MSP at the local market. The main reasons for the low productivity of sesame are its rainfed cultivation in marginal and sub-marginal lands under poor management and input-starved conditions. However, improved varieties and agro-production technologies capable of increasing the productivity levels of sesame are now developed for different agro-ecological situations in the country. A well-managed crop of sesame can yield 1200-1500 kg ha^{-1} under irrigated and 800-1000 kg ha^{-1} under rainfed conditions. Erratic rainfall (drought and higher rainfall) in the state affected the yield from 2016 to 2020. Farmers responded that disease & insect infestation (specifically phyllody and leafhopper) and lack of access to quality chemicals at a reasonable cost are severe constraints for sesame production in Rajasthan. A few farmers also reported that they faced post-harvesting losses due to a lack of storage facilities.

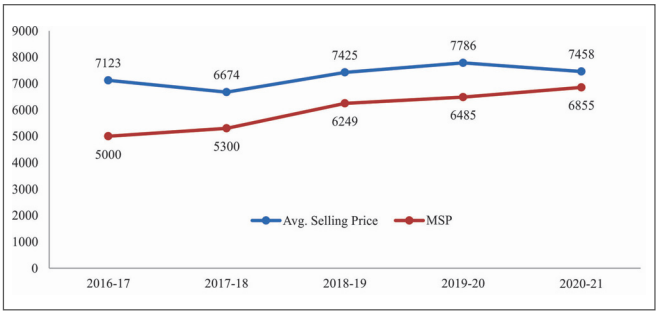

Figure 3. Selling price and minimum support price of sesame from 2016 to 2021

CONCLUSION

Sesame is a protein-rich edible oil crop that can be grown in almost all areas at 25-35ºC temperature. In the intervention areas, sesame production and productivity enhanced due to improved varieties and better extension services. Improved variety of sesame (RT-351) had a yield advantage of 36.17 per cent and generated an additional income of 1.45 crore. Large-scale demonstrations of this variety, exhibited more capsules per plant and resistance to stem and root rot, which attracted farmers and resource persons' attention to grow this variety in the coming year. The results suggested that technical backstopping and supplying of early generation seed, and introducing seed exchange through farmer-to-farmer extension are crucial to crop production and productivity improvement on a sustainable basis.

REFERENCES

Anonymous. (2020). *Food and Agriculture Organization Statistical Databases* (FAOSTAT). Available online: http://faostat.fao.org/ (accessed on 29 June 2021).

Anonymous. (2020a). Agricultural statistics at a glance 2019. Directorate of Economics & Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi, pp. 315.

Kumbhare, N. V., Dubey, S. K., Nain, M. S., & Bahal, R. (2014). Micro analysis of yield gap and profitability in pulses and cereals. *Legume Research- An International Journal*, *37*(5), 532-536.

Kushahwah, R. S., Kumar, R., Sharma, U. C., Bhadauria, N. S., Kushwaha, N. K., & Kumar, C. (2018). Impact of frontline demonstration technologies on sesame crop yield in Bhind district (MP). *Indian Research Journal of Extension Education*, *18*(2), 97-100.

Linn, J. F., Hartmann, A., Kharas, H., Kohl, R., & Massler, B. (2010). *Scaling up the fight against rural poverty*. Working Paper 43. Brookings. Available at: www. brookings. edu/ wpcontent/uploads/2016/06/10_ifad_linn_kharas. pdf.

Mbure, G., & Sullivan, C. (2017). Improving the management of agriculture demonstration sites in food security programs: A practitioner's guide. *Washington, DC: World Vision.*

Meena, M. S., Kale, R. B., Singh, S. K., & Rohilla, P. P. (2017). *Performance of cluster frontline demonstrations on oilseeds in Rajasthan and Gujrat*. ICAR-Agricultural Technology Application Research Institute, Jodhpur, technical report, 8/ 2017: pp 1-36.

Meena, M. S., Singh, S. K., & Meena, H. N. (2018). *Cluster front-line demonstrations under NMOOP: Efforts of KVKs of Rajasthan, Haryana, and the Delhi states*. ICAR-Agricultural Technology Application Research Institute, Jodhpur, annual report pp 1-42.

Myint, D., Gilani, A., Kawase, M., & Watanabe, N. (2020). Sustainable sesame (*Sesamum indicum* L.) production through improved technology: An overview of production, challenges, and opportunities in Myanmar. *Sustainability*, *12*, 3515.

Nain, M. S., Bahal, R., Dubey, S. K., & Kumbhare, N. V. (2014). Adoption gap as the determinant of instability in Indian legume production: Perspective and implications. *Journal of Food Legumes*, *27*(2), 146-150.

Nain, M. S., Kumbhare, N. V., Sharma, J. P., Chahal, V. P., & Bahal, R. (2015). Status, adoption gap and way forward of pulse production in India. *Indian Journal of Agricultural Sciences*, *85*(8), 1017-1025.

Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., & Vanclay, F. (2006). Adoption of conservation practices by rural landholders. *Australian Journal of Experimental Agriculture*, *46*(11), 1407-1424.

Patil, S., Mahale, M., Chavan, S., & Shinde, V. (2018). Impact of frontline demonstrations on oilseed crops in Konkan region of Maharashtra. *Indian Research Journal of Extension Education*, *18*(4), 30-36.

Patil, S., Mahale, M., Chavan, S., & Shinde, V. (2019). Impact of frontline demonstrations on oilseed crops in konkan region of Maharashtra. *Indian Research Journal of Extension Education*, *19*(2), 70-76.

Rai, A.K., Kajuria, S., & Lata, K. (2012). Impact of FLDs on sesame production in Panchmahal district of Gujarat. *Indian Journal of Extension Education*, *48*(3&4), 45-48.

Ranganatha, A. R. G., Jyotishi, A., Deshmukh, M. R., Bisen. R., Panday, A. K., Gupta, K. N., Jain, S., & Paroha, S. (2013). Improved technology for maximizing production of sesame. All India coordinated research project on sesame and niger, *Indian Council of Agricultural Research, JNKVV Campus, Jabalpur*. Available online: https://icariior.org.in/sites/default/files/ iiorcontent/pops/sesame.pdf (accessed on 25 January 2022).

Singh, A. K., Chauhan, R., Rikhari, Y. C., & Kumar, P. (2020). Evaluation of front-line demonstration on the mustard crop in Bundelkhand Zone. *Indian Journal of Extension Education*, *56*(1), 18-22.

Singh, K. K., Singh, R. P. N., & Mishra, D. (2019). Evaluation of front-line demonstration of oilseeds in Raebareli district. *Indian Journal of Extension Education*, *55*(3), 49-52.

Sri, G. A. L., Kumar, G. D. S., & Khan, M. A. (2022). Farmers' characteristics effecting the yield gap in oilseed crops. *Indian Research Journal of Extension Education*, *22*(5), 59-62.

Tripathi, A. K., & Singh, D. K. (2012). Performance and adoption of improved production technology of sesame (*Sesamum indicum* L.) in Bundelkhand region of Madhya Pradesh. *Indian Journal of Extension Education*, *48*(3&4), 98-100.