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Assessment of Avoidable Losses Caused by Leaf Webber and Capsule Borer (*Antigastra Catalaunalis* Dup.) in Promising Sesame Varieties

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Abstract: An experiment was conducted during the kharif seasons of 2018 and 2019 with varieties viz., RT 346, RT 351, TKG 306, TKG 308, Rama, VRI 1, GT 10 and TKG 22 of sesame (*Sesamum indicum* L.) to assess the avoidable loss in seed yield due to leaf webber and capsule borer under rainfed conditions at ARS, Mandor. The performance of all the promising sesame varieties grown under protected conditions were found significantly superior over the unprotected conditions, except in case of two varieties viz., TKG-308 and VRI-1 at capsule stage only. The varieties viz., RT 351, TKG 308 and GT 10 were found significantly superior over all other varieties of sesame grown under both the protected and unprotected conditions. Avoidable loss recorded ranged from 25.51 to 61.45% in different varieties under protected condition in comparison to unprotected conditions, maximum in RT 351 and minimum in VRI 1 due to leaf webber and capsule borer. The pest caused significant loss in seed yield under unprotected condition in comparison to protected condition. The varieties viz., TKG 308, RT 351 and GT 10 performed good under unprotected conditions and gave highest seed yield, the variety GT 10 stands first in respect to record lowest damage (9.58%, 15.89% and 5.40% at vegetative, flowering and capsule stage, respectively) under unprotected conditions. Varieties viz., RT 351, TKG 308 and GT 10 gave highest seed yields of 444 kg ha^{-1}, 433 kg ha^{-1} and 397 kg ha^{-1}, respectively, under protected condition. Overall, all the varieties performed well in protected conditions and their yield potential were also increased.

Key words: Sesame, varieties, *Antigastra catalaunalis*, avoidable loss.

Sesame (*Sesamum indicum* L.) from the family Pedaliaceae is known as the queen of oilseeds. India stands second as highest contributor in production of sesame around the world. It contributes 25% of the global production. In India, sesame is cultivated on an area of 13.71 lakh ha with production of 3.9 lakh MT and productivity of 291 kg ha^{-1} (Anonymous, 2019). Sesame is regarded as a prime source of vegetable oil (46-64%), 25% of protein and contains good quantity of minerals such as calcium, iron and phosphorous. Its oil is a prosperous source of unsaturated fatty acids mainly linoleic acid (37-47%) and oleic acid (35-43%) (Pathak *et al*., 2014). Due to presence of potent antioxidants, sesame seeds are known as "the seed of immorality". Sesame seeds contain methionine as sulphur containing amino acids (Prasad *et al*., 2012). Sesame crop is attacked by 29 insect pests which affect the yield. Among them, leaf webber and capsule borer, *Antigastra catalaunalis* (Duponchel) attacks the crop right from seedling stage till maturity of capsule (Mishra *et al*., 2016). This insect belongs to order Lepidoptera and family Pyraustidae, is considered to be most destructive pest throughout India that causes economic losses starting from germination to harvest in crop yield of sesame (Thakur and Ghorpade, 2006). Cheema and Singh (1987) reported 53.1% less seed in the infested capsules due to leaf webber and capsule borer. Choudhary and Singh (1986) reported avoidable loss of 90% in seed yield in sesame variety 'JT 7' whereas Shrivastava *et al*. (1989) reported 4.3 to 27.52% yield loss in sesame variety 'N 32' due to leaf webber and capsule borer. Of late, many new high yielding varieties of sesame have been developed in India, but there is very little information available on the extent of loss caused by this insect. Hence, an experiment was conducted to assess the avoidable loss in seed yield due to this pest in different varieties of sesame in the Jodhpur region.

Materials and Methods

A field experiment was laid out in factorial randomized block design with eight varieties (viz., RT 346, RT 351, TKG 306, TKG 308, Rama,

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VRI 1, GT 10 and TKG 22) of sesame, replicated three times during the kharif seasons of 2018 and 2019 at field of Agricultural Research Station, Mandor, Jodhpur. The varieties were sown under protected and unprotected sets of conditions at the onset of monsoon. Under protected conditions, the crop was protected by seed treatment with Imidacloprid 600FS @ 5.0 ml kg^{-1} of seed followed by foliar sprays of Profenofos 50 EC @ 2.0 ml L^{-1} of water given at 25, 40 and 55 days after sowing. The crop was grown under rainfed condition with 30 cm spacing between lines and 10 cm between plants. Recommended agronomical practices were followed to raise the crop under protected and unprotected situations. Observation on damage at different stages viz., vegetative (30 DAS), flowering (45 DAS) and capsule (70 DAS), due to leaf webber and capsule borer was recorded and per cent damage was worked out. Seed yield was also recorded after harvest. The loss (%) in seed yield for each variety compared with the respective unprotected control plot was calculated. Plant infestation (%) due to *A. catalaunalis* was worked out by counting the number of plants/plots. The number of plants infested was recorded and the percentage of plant infested was calculated. For flower damage (%) and capsule damage (%), the total number of flower and capsule were counted on ten selected plants/plot randomly. The number of flower and capsule infested were recorded and the percentage of flower and capsule damage were calculated. Cost benefit ratio was also calculated. The pooled data of two years were statistically analysed by Window State Program.

Results and Discussion

Leaf webber and capsule borer occurred as a major insect pest of sesame during cropping season which caused damage at vegetative, flowering and capsule stages on different varieties under protected and unprotected conditions. The performance of all the promising sesame varieties grown under protected conditions were found significantly superior over the unprotected conditions, except in case of two varieties viz., TKG-308 and VRI-1 at capsule stage only. The varieties viz., RT 351, TKG 308 and GT 10 were found significantly superior over all other varieties of sesame grown under both the protected and unprotected conditions.

Under unprotected conditions, the maximum plant infestation was recorded in TKG 22 (22.14%) in comparison to other varieties at vegetative stage. Flower damage (25.50%) caused by leaf webber and capsule webber in TKG 22 was statistically at par with damage occurred in varieties, RAMA (22.58%) and TKG 308 (22.37%). Maximum capsule damage (11.72%) was recorded in TKG 22 which was at par with TKG 308 (10.46%) under unprotected conditions. The lowest plant infestation (9.58%), flower damage (15.89%) and capsule damage (5.40%) were recorded in GT 10 under unprotected conditions and found significantly superior over all other varieties at vegetative stage, whereas it was found significantly superior over other varieties except RT 346 and RT 351 at flowering stage, and except RT 351 and VRI 1 at capsule stage. The maximum seed yield (281 kg ha^{-1}) was recorded in TKG 308 which was found significantly at par with RT 351, GT 10 and VRI 1 under unprotected conditions.

Under protected conditions, the minimum plant infestation, flower damage and capsule damage were recorded in varieties viz., RAMA (6.56%), RT 351 (9.26%) and GT 10 (2.30%), respectively, whereas maximum plant infestation, flower damage and capsule damage were recorded in TKG 22 (22.14% and 15.05%) and TKG 306 (5.61%), respectively. Similarly, Shrivastava *et al*. (1989) reported 4.3 to 27.52% yield loss in sesame variety 'N 32' due to leaf webber and capsule borer. However, maximum seed yield (444 kg ha^{-1}) was recorded in RT 351 which was statistically at par with TKG 308 (433 kg ha^{-1}) and found significantly superior over all other varieties.

The highest avoidable loss (61.45%) in seed yield was recorded in RT 351 followed by TKG 308 (54.09%) whereas lowest avoidable loss (25.51%) was recorded in VRI 1 followed by RT 346 (31.44%) (Table 1). Similarly, Choudhary and Singh (1986) reported 90% avoidable losses in seed yield of sesame variety "JT-7" due to leaf webber and capsule borer. All the varieties performed better under protected condition which was revealed by comparing the cost benefit ratio obtained under protected and unprotected conditions. Varieties responded in different ways against leaf webber and capsule borer under different environmental conditions. The highest cost benefit ratio (1.97)

Table 1. Assessment of damage caused by leaf webber and capsule borer (Antigastra catalaunalis) in promising sesame varieties under protected and unprotected conditions (Pooled data of 2018 and 2019)

Variety	Plant damage (%)		Flower damage (%)		Capsule damage (%)	
	P	UNP	P	UNP	P	UNP
RT-346	7.79 (16.11)	15.43 (23.09)	12.53 (20.49)	17.99 (24.82)	5.05 (12.81)	8.44 (16.84)
RT-351	6.98 (15.25)	14.71 (22.51)	9.26 (17.54)	19.10 (25.86)	3.50 (10.73)	7.04 (15.34)
TKG-306	8.40 (16.82)	16.99 (24.32)	12.43 (20.63)	20.08 (26.56)	5.61 (13.62)	8.23 (16.54)
TKG-308	8.98 (17.34)	15.49 (23.04)	10.69 (18.98)	22.37 (28.15)	5.12 (13.03)	10.46 (18.85)
RAMA	6.56 (14.62)	13.37 (21.44)	9.74 (18.05)	22.58 (28.24)	5.32 (13.30)	8.85 (17.10)
VRI-1	9.15 (17.58)	13.97 (21.90)	9.44 (17.88)	20.93 (27.19)	4.62 (12.30)	6.89 (15.07)
GT-10	6.90 (15.19)	9.58 (17.96)	9.32 (17.64)	15.89 (23.41)	2.30 (8.57)	5.40 (13.40)
TKG-22	9.60 (17.92)	22.14 (28.02)	15.05 (22.74)	25.50 (30.29)	5.09 (12.96)	11.72 (19.96)
SEm ±	0.43	0.87	0.48	0.96	0.36	0.72
C.D. (P = 0.05)	1.26	2.52	1.39	2.78	1.05	2.09
SEm ± (P x UNP)	1.23		1.36		1.02	
C.D. (P = 0.05) (P x UNP)	3.56		3.94		2.96	
CV%	10.92		10.24		12.33	

*Figures in parenthesis are ARCsin value.

was obtained in RT 351 followed by TKG 306 (1.92) whereas minimum cost benefit ratio (1.05) was obtained in TKG 22 (Table 2).

The data revealed in Table 1 and 2 that the performance of all the varieties was found good under protected conditions in comparison to unprotected conditions. It was also confirmed that adoption of protection measures is essential to obtain full potential of the crop varieties along with agronomic practices and avoid the losses occurred due to leaf webber and capsule borer in sesame varieties. The difference between the seed yield obtained under protected condition was significantly superior over the seed yield obtained under unprotected condition except in VRI 1. Among the white seeded varieties RT 351 and TKG 308 performed better in both the conditions *i.e.* protected and unprotected. Ahuja (1991) found that RT 46 performed better in both the

Table 2. Assessment of yield losses due to leaf webber and capsule borer (Antigastra catalaunalis) in promising sesame varieties under protected and unprotected conditions (Pooled data of 2018 and 2019)

Variety	Seed yield (kg ha^{-1})			Mean (%) avoidable loss	Input cost (Rs. ha^{-1})		Gross income (Rs. ha^{-1})		Net return (Rs. ha^{-1})		C:B ratio	
	P	UNP	Increased in yield		P	UNP	P	UNP	P	UNP	P	UNP
RT-346	301	229	72	31.44	15762	14000	21070	16030	5308	2030	1.34	1.15
RT-351	444	275	169	61.45	15762	14000	31080	19250	15318	5250	1.97	1.38
TKG-306	289	216	73	33.80	15762	14000	20230	15120	4468	1120	1.28	1.08
TKG-308	433	281	150	54.09	15762	14000	30310	19670	14548	5670	1.92	1.41
RAMA	289	216	73	33.80	15762	14000	20230	15120	4468	1120	1.28	1.08
VRI-1	305	243	62	25.51	15762	14000	21350	17010	5588	3010	1.35	1.22
GT-10	397	262	135	51.53	15762	14000	27790	18340	12028	4340	1.76	1.31
TKG-22	285	210	75	35-71	15762	14000	19950	14700	4188	700	1.27	1.05
SEm ±	8.46	16.92	-	-	-	-	-	-	-	-	-	-
C.D. (P = 0.05)	24	49	-	-	-	-	-	-	-	-	-	-
SEm ± (P x UNP)	23.93		-	-	-	-	-	-	-	-	-	-
C.D. (P = 0.05) (P x UNP)	69.00		-	-	-	-	-	-	-	-	-	-
CV%	14.18		-	-	-	-	-	-	-	-	-	-

conditions. GT 10 performed better under both the conditions among black and brown seeded varieties viz., VRI 1, GT 10 and RAMA.

Conclusion

It was inferred from these findings that adoption of protection measures is essential to obtained full potential of crop varieties. Sesame varieties, RT 351, TKG 308 and GT 10 may be preferred for cultivation in arid zone of Rajasthan.

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