

Efficacy of various edible and non-edible oils against *Sitophilus oryzae* L. in sorghum

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ABSTRACT

Research study on the efficacy of various edible and non-edible oils against rice weevil, *Sitophilus oryzae* (Linnaeus) on stored sorghum was carried out during the year 2007-08 and 2008-09 at the Main Sorghum Research Station, Navsari Agricultural University, Surat, Gujarat state. The results of study on per cent grain damage and weight loss of grains treated with various edible and non-edible oil revealed that the least grain damage and weight loss were found in grains treated with groundnut oil 5 ml/ kg of seed and mustard oil 5 ml/ kg of seed against *S. oryzae* on sorghum.

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INTRODUCTION

Sorghum grain is attacked by a number of insect pests under storage condition, of which rice weevil, *Sitophilus oryzae* is a major pest of stored grains. Both larval and adult stages are destructive being internal feeder. The infested seeds are unfit either for sowing or for human consumption. The problem of residues resulting from mixing of synthetic pesticides for control of the infestation has compelled the researchers to look for some non-toxic protectants. Hence, investigations were made to know some effective control strategies which would not pollute the environment.

MATERIAL AND METHODS

The seeds of sorghum variety GJ 38 were treated

with five different edible and non edible oils viz., mustard oil, linseed oil, sunflower oil, groundnut oil and castor oil with two concentration of each 2.5 ml/ kg and 5.0 ml/ kg of seeds. These oils were thoroughly mixed with one kg of seed manually by hand for five minutes (Table A). Hundred grams of treated seeds were put into test tube (10 x 25 cm) in three sets for each treatment. Freshly emerged weevils were drawn from the stock culture bottle and released at the rate of 10 pairs of adults per test tube. Test tubes were covered with muslin cloth and fastened with rubber band. Each treatment was replicated 3 times. Observations on seed damage and weight loss were recorded at 30 days interval up to 180 days. Per cent weight loss was calculated by using the formula (Adams and Schulton, 1978) as below:

$$\text{Per cent weight loss} = \frac{(\text{UND}) - (\text{DNU})}{\text{U} (\text{ND} + \text{NU})} \times 100$$

Sr. No.	Name	Dosage (ml/kg)
1.	Mustard oil	2.5
		5.0
2.	Linseed oil	2.5
		5.0
3.	Sunflower oil	2.5
		5.0
4.	Ground nut oil	2.5
		5.0
5.	Castor oil	2.5
		5.0

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Per cent grain damage due to *S. oryzae* in sorghum treated with edible and non-edible oils:

The pooled data over for per cent grain damage of two year 2007-08 and 2008-09 (Table 1) revealed that there was no grain damage in all the treatments 30 and 60 day after storage (DAS). While 90 DAS least per cent of grain damage was recorded in the treatment of groundnut oil 5 ml/ kg of seed (7.00%). The next best treatment was mustard oil 5 ml/ kg of seed (14.00%) followed by the groundnut oil 2.5 ml/ kg of seed (15.00%).

Sr. No.	Treatments	Per cent grain damage						Mean
		30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	
1.	Mustard oil 2.5 ml/ kg	0.41a	0.41a	29.76e	36.05d	41.34e	44.22d	25.36d
		(0.00)*	(0.00)	(24.67)	(34.67)	(43.67)	(48.67)	(25.28)
2.	Mustard oil 5.0 ml/ kg	0.41a	0.41a	21.94b	29.31b	35.45b	38.43b	20.99b
		(0.00)	(0.00)	(14.00)	(24.00)	(33.67)	(38.67)	(18.39)
3.	Linseed oil 2.5 ml/ kg	0.41a	0.41a	57.93h	64.63i	73.23h	78.52h	47.24g
		(0.00)	(0.00)	(63.67)	(73.50)	(83.50)	(88.17)	(51.47)
4.	Linseed oil 5.0 ml/ kg	0.41a	0.41a	49.20g	55.12h	61.55g	65.13i	38.64i
		(0.00)	(0.00)	(36.17)	(46.17)	(56.17)	(61.17)	(33.28)
5.	Sunflower oil 2.5 ml/ kg	0.41a	0.41a	31.93f	37.94e	43.64f	46.51e	26.81e
		(0.00)	(0.00)	(28.00)	(37.84)	(47.67)	(52.67)	(27.70)
6.	Sunflower oil 5.0 ml/ kg	0.41a	0.41a	24.83d	31.72c	37.84d	40.77c	22.66c
		(0.00)	(0.00)	(17.66)	(27.67)	(37.67)	(42.67)	(20.95)
7.	Groundnut oil 2.5 ml/ kg	0.41a	0.41a	22.76c	29.98b	36.25c	39.21b	21.50b
		(0.00)	(0.00)	(15.00)	(25.00)	(35.00)	(40.00)	(19.17)
8.	Groundnut oil 5.0 ml/ kg	0.41a	0.41a	15.27a	24.07a	31.07a	34.23a	17.57a
		(0.00)	(0.00)	(7.00)	(16.67)	(26.67)	(31.67)	(13.67)
9.	Castor oil 2.5 ml/ kg	0.41a	0.41a	38.62g	44.31f	49.98g	52.92f	31.11f
		(0.00)	(0.00)	(39.00)	(48.84)	(58.67)	(63.67)	(35.03)
10.	Castor oil 5.0 ml/ kg	0.41a	0.41a	32.14f	38.24e	44.03f	46.89e	27.02e
		(0.00)	(0.00)	(28.33)	(38.33)	(48.33)	(53.33)	(28.05)
11.	Control	30.27b	36.54b	59.54i	66.67j	76.26i	80.13g	56.85h
		(25.79)	(35.60)	(74.33)	(84.33)	(94.33)	(97.00)	(68.56)
	S.E. ±	0.50	0.45	0.26	0.26	0.28	0.40	1.87
	C.D. (P=0.05)	1.57	1.42	0.75	0.75	0.78	1.27	5.24
	T x Y							
	S.E. ±	0.30	0.28	0.39	0.41	0.40	0.37	0.36
	C.D. (P=0.05)	0.86	0.78	NS	NS	NS	1.05	1.01
	CV %	16.74	12.92	1.97	1.70	1.45	1.24	2.06

* Figures in the parentheses are original values and those outside the parentheses are arcsine transformed values.

NS=Non-significant

The maximum per cent of grain damage was recorded in the treatment of linseed 2.5 ml/ kg of seed (63.67). Whereas control recorded 74.33 per cent grain damage. The 120 DAS pooled data revealed that least per cent of grain damage was recorded in the treatment of groundnut oil 5 ml/ kg of seed (16.67). The next best treatment was mustard oil 5 ml/ kg of seed (24.00%) and it was at par with the groundnut oil 2.5 ml/ kg of seed (25.00%). The maximum per cent of grain damage was recorded in the treatment of linseed 2.5 ml/ kg of seed (73.50). Whereas, control recorded 84.33 per cent grain damage. The pooled data for per cent grain damage of two year at 150 DAS revealed that least per cent of grain damage was recorded in the treatment of groundnut oil 5 ml/ kg of seed (26.67). The next best treatment was mustard oil 5 ml/ kg of seed (33.67) followed by the

groundnut oil 2.5 ml/ kg of seed (35.00%). The maximum per cent of grain damage was recorded in the treatment of linseed 2.5 ml/ kg of seed (83.50). Whereas control recorded 94.33 per cent grain damage at 150 DAS. 180 DAS the pooled data revealed that least per cent of grain damage was recorded in the treatment of groundnut oil 5 ml/ kg of seed (31.67). The next best treatment was mustard oil 5 ml/ kg of seed (38.67%) and it was at par with the groundnut oil 2.5 ml/ kg of seed (40.00%). The maximum per cent of grain damage was recorded in the treatment of linseed 2.5 ml/ kg of seed (88.17). Whereas control recorded 97.00 per cent grain damage 180 DAS.

Thus, overall conclusion from the study on edible oil and non-edible oil against *S. oryzae* on sorghum can be drawn that most effective treatments were groundnut oil 5 ml/ kg of seed recorded 13.67 per cent and mustard

Table 2 : Per cent weight loss due to *S. oryzae* when treated with edible and non-edible oils (Pooled of 2007-08 and 2008-09)

Sr. No.	Treatments	Per cent weight loss						Mean
		30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	
1.	Mustard oil 2.5 ml/ kg	4.05a (0.50)*	7.04a (1.50)	9.10a (2.50)	38.76g (39.17)	41.67e (44.17)	44.31g (48.83)	28.52c (22.78)
2.	Mustard oil 5.0 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	16.74b (8.34)	21.30b (13.17)	24.95b (17.84)	15.68ab (7.31)
3.	Linseed oil 2.5 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	39.52g (40.50)	42.42e (45.50)	45.29g (50.50)	29.00c (23.50)
4.	Linseed oil 5.0 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	31.44e (27.17)	34.57d (32.17)	37.58e (37.17)	24.20bc (16.84)
5.	Sunflower oil 2.5 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	36.39f (35.17)	39.35e (40.17)	42.25f (45.17)	27.13c (20.84)
6.	Sunflower oil 5.0 ml/ kg	3.34a (0.34)	7.04a (1.50)	9.10a (2.50)	25.25d (18.23)	28.73c (23.06)	33.65d (30.66)	20.88b (12.71)
7.	Groundnut oil 2.5 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	23.42c (15.83)	27.13c (20.83)	30.53c (25.83)	19.55b (11.17)
8.	Groundnut oil 5.0 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	12.25a (4.50)	16.95a (8.50)	21.56a (13.50)	13.18a (5.17)
9.	Castor oil 2.5 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	30.53e (25.83)	32.71d (29.17)	36.75e (35.83)	23.50bc (15.89)
10.	Castor oil 5.0 ml/ kg	4.05a (0.50)	7.04a (1.50)	9.10a (2.50)	23.19c (15.50)	26.92c (20.50)	30.33c (25.50)	19.37b (11.00)
11.	Control	26.56b (20.40)	32.65b (29.07)	45.29b (51.46)	47.70h (53.66)	51.30f (60.91)	55.24h (67.46)	43.39d (47.16)
	S.E. ±	3.64	3.17	0.16	0.49	1.30	0.45	2.12
	C.D. (P=0.05)	11.49	9.99	0.46	1.39	3.69	1.28	5.95
	T x Y							
	S.E. ±	0.47	0.26	0.25	0.73	1.89	0.69	0.91
	C.D. (P=0.05)	1.38	0.75	NS	NS	NS	NS	2.66
	CV %	16.31	4.96	3.78	3.68	8.80	2.90	6.82

* Figures in the parentheses are original values and those outside the parentheses are arcsine transformed values.

NS=Non-significant

oil 5 ml/ kg of seed recorded 18.39 per cent grain damage. Whereas the treatment of groundnut oil 2.5 ml/ kg of seed recorded 19.17 per cent grain damage and found least effective in preventing the grain damage. However, all the treatments gradually lost their effectiveness with the increase the period of grain storage (Fig. 1). The

present investigation was supported by the work of Dey and Sarup (1993) who confounded that percentage reduction in the average weevil population was highest in case of soybean oil at 3.30 ml/ kg of grain followed by cotton seed and coconut oils. Similar investigation was also done by Katare *et al.* (2012a); Sahoo and

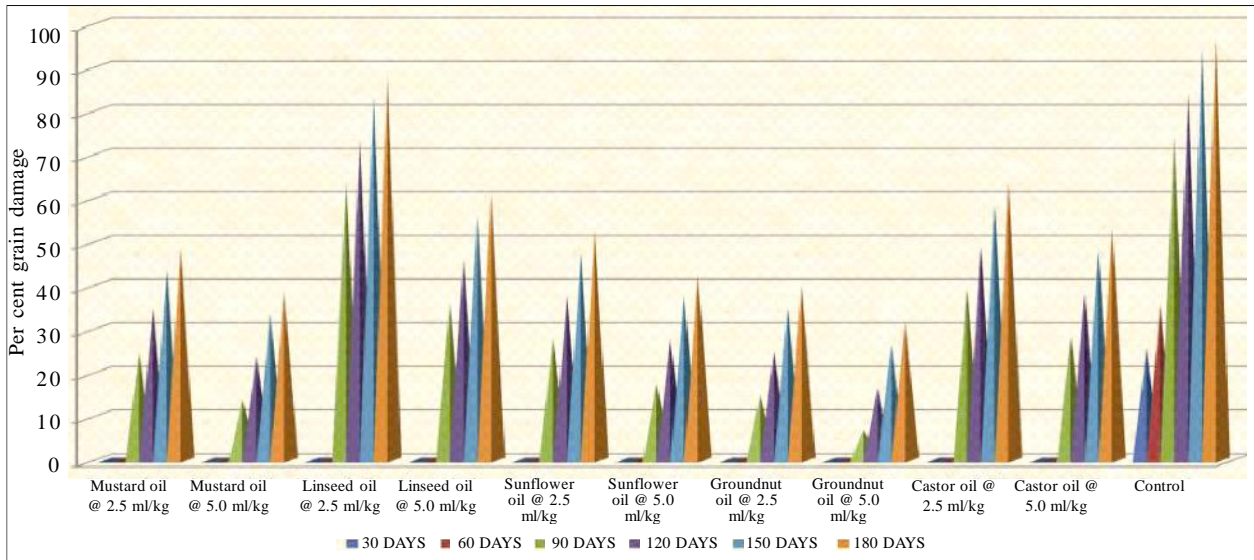


Fig. 1 : Per cent grain damage due to *Sitophilus oryzae* in sorghum treated with edible and non-edible oils (Pooled)

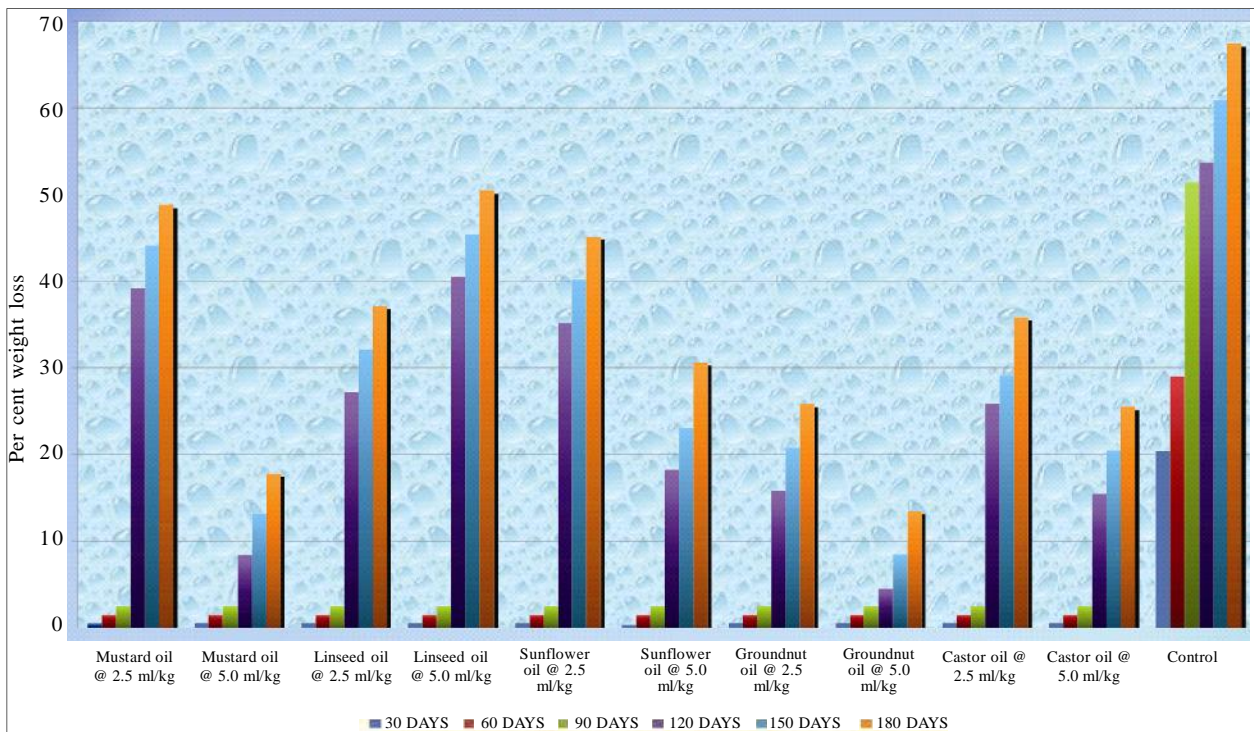


Fig. 2 : Per cent weight loss due to *Sitophilus oryzae* when treated with edible and non-edible oils (Pooled)

Chandrakar (2013); Katare and Sharma (2012b) and the results found were more or less similar to the present investigation.

Per cent weight loss due to *S. oryzae* in sorghum treated with edible and non-edible oils :

The pooled data of per cent weight loss of two year 2007-08 and 2008-09 (Table 2) revealed that there was least per cent of weight loss in all the treatments was observed 30, 60 and 90 DAS. The pooled data for per cent weight loss of two year 2007-08 and 2008-09 (Table 2) revealed that 120 DAS least per cent of weight loss was recorded in the treatment of groundnut oil 5 ml/ kg of seed (4.50). The next best treatment was mustard oil 5 ml/ kg of seed (8.34%) and it was at par with the castor oil 5 ml/ kg of seed (15.50%). The maximum per cent of weight loss was recorded in the treatment of linseed 2.5 ml/ kg of seed (40.50) and it is at par with control recorded 53.66 per cent weight loss. While 150 DAS the pooled data for per cent weight loss revealed that least per cent of weight loss was recorded in the treatment of groundnut oil 5 ml/ kg of seed (8.50). The next best treatment was mustard oil 5 ml/ kg of seed (13.17%). The maximum per cent of weight loss was recorded in the treatment of linseed 2.5 ml/ kg of seed (45.50) and in control 60.91 per cent weight loss. In case of 180 DAS the pooled data for per cent weight loss of two years revealed that least per cent of weight loss was recorded in the treatment of groundnut oil 5 ml/ kg of seed (13.50). The next best treatment was mustard oil 5 ml/ kg of seed (17.84%) followed by castor oil 5 ml/ kg of seed (25.50%) and the groundnut oil 2.5 ml/ kg of seed (25.83%). The maximum per cent of weight loss was recorded in the treatment of linseed 2.5 ml/ kg of seed (50.50) and at par with control (67.46%). Thus, overall conclusion from the study on edible oil and non edible oil against *S. oryzae* on sorghum can be drawn that most effective treatments were groundnut oil 5 ml/ kg of seed recorded 5.17 per cent and mustard oil 5 ml/ kg of seed 7.31 per cent weight loss, respectively. Whereas the treatment of groundnut oil 2.5 ml/ kg of seed recorded 11.17 per cent weight loss and found least effective in preventing the weight loss caused by the *S. oryzae*. However, all the treatments gradually lost their effectiveness with the increase in the period of grain storage (Fig. 2). Uttam *et al.* (2002) were tested ten indigenous oils and found that mustard and sesamum oils

provided best performance after 5 days of application. Whereas Shukla *et al.* (1992) reported that palm, mustard, soybean, sesamum and groundnut oil cause 90.48 per cent mortality of *S. oryzae*. This is in support with the present findings. Katare *et al.* (2012 c); Ramesh (1993); Reddy *et al.* (1994) and Jyothi *et al.* (2014) also worked on the related topic.

Summary :

The overall conclusion from the study on edible oil and non-edible oil against *S. oryzae* on sorghum can be drawn that most effective most effective treatments were groundnut oil 5 ml/ kg of seed recorded 13.67 per cent and mustard oil 5 ml/ kg of seed recorded 18.39 per cent grain damage. Whereas the treatment of groundnut oil 2.5 ml/ kg of seed recorded 19.17 per cent grain damage and found least effective in preventing the grain damage. While in case of weight loss, most effective treatments were groundnut oil 5 ml/ kg of seed recorded 5.17 per cent and mustard oil 5 ml/ kg of seed 7.31 per cent weight loss, respectively. Whereas the treatment of groundnut oil 2.5 ml/ kg of seed recorded 11.17 per cent weight loss and found least effective in preventing the weight loss caused by the *S. oryzae*. However, all the treatments gradually lost their effectiveness with the increase the period of grain storage.

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