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Efficacy of various inert materials against *Sitophilus oryzae* in sorghum

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ABSTRACT

Research study on the screening of sorghum genotypes 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 plant products revealed that the least grain damage and weight loss were found in grains treated with kaolinite clay 10 per cent and bentonite clay 10 per cent against *S. oryzae* on sorghum.

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INTRODUCTION

Sorghum grain is attacked by a number of insect pests under storage conditions, of which rice weevil, *Sitophilus oryzae* is a major pest of stored grains. Both larval and adult stages are destructive being internal feeder. It causes great economic loss both in quality and quantity. A number of scientists have suggested several control measures for making the stored products free from insect pests. Considerable amount of food grains is being spoiled after harvest due to lack of sufficient storage and processing facilities (Singh and Satapathy, 2003).Use of insecticide is an easy and economic approach, but due to its toxic effects, it is unsafe for environment and human consumption. Currently, chemical control is the most commonly used strategy against the pests. There are many chemicals that are toxic to stored-grain pests, including insecticides such as organophosphates, pyrethroids and fumigants such as methyl bromide and phosphine (Park *et al.,* 2003; Kljajic and Peric, 2006). These chemicals are effective for pest control but have several problems to users (Subramanyam and Hagstrum, 1995; Okonkwo and Okoye, 1996). Thus, repellents, fumigants, feeding deterrents and insecticides of natural origin are all rational alternatives to synthetic insecticides. Botanical insecticides composed of essential oils may prove to be a reasonable alternative to the more persistent synthetic pesticides (Chiasson *et al.,* 2004). It has also provoked undesirable effects, including toxicity to nontarget organisms and fostered environmental and human health concerns (Lee *et al.,* 2001). To observe the drawback of such pesticides and fumigants, one of the eco-friendly and economic approaches to keep the stored food grains free from insect attack, would be using the plant powders and inert materials as grain protectants (Mishra *et al*., 1992; Rao and Sarangi, 1998 and Tewari and Tiwari, 2008). The present investigation was undertaken to find out an eco-safe management of *Sitophilus oryzae* in stored sorghum.

MATERIAL AND METHODS

Preparation of inert materials :

Dry cow dung pellets were collected and burnt to get

the ash. Sawdust was collected from the carpenters. Kaolinite clay and bentonite clay were obtained from the Soil Science Laboratory, Main Cotton Research Station, Surat. Each of the grain protectants at the desired dosage was thoroughly mixed with 100 g uninfected seeds of GJ-38 variety in plastic bottles of 500 g capacity. Freshly emerged weevils were drawn from the stock culture bottle and released at the rate of 10 pairs of adults per bottle. Bottles 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 grain damage was recorded on the basis of number of healthy and damage grain. Per cent weight loss was calculated by using the formula (Adams and Schulton, 1978) as below :

Table A : List of inert materials used against *Sitophilus oryzae*

Sr. No.	Name	Dosage in per cent (w/w)
1.	Kaolinite clay	10
2.	Cow dung ash	10
3.	Sawdust	10
4.	Sand	10
5.	Bentonite	10

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

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 inert materials :

The pooled data for per cent grain damage over two year (Table 1) revealed that there was no grain damage in treatments of kaolinite clay 10 per cent and bentonite 10 per cent. While, second best treatment was sand 10 per cent (36.38%) and it was followed by the treatment of saw dust 10 per cent with 45.63 per cent grain damage. The maximum per cent of grain damage was observed in the treatment of cow dung ash 10 per cent (50.75%) as compared to control (63.13%) 30 day after storage. The pooled data for per cent grain damage of two years 2007-08 and 2008-09 (Table 1) revealed that at 60 DAS there was no grain damage in treatments of kaolinite clay 10 per cent and bentonite 10 per cent. While, second best treatment was sand 10 per cent (61.75%) and it was followed by the treatment of cow dung ash 10 per cent with 67.38 per cent grain damage. The maximum per cent of grain damage was observed in the treatment of saw dust 10 per cent (69.50%) as compared to control (74.00%). 90 DAS the pooled data for per cent grain damage over two years (Table 1) revealed that there was no grain damage in the treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (8.50%). The next best treatment was sand 10 per cent (66.50%) and it was followed by the treatment of saw dust 10 per cent with 73.00 per cent grain damage. The maximum per cent of grain damage was observed in the treatment of cow dung ash 10 per cent (75.25) as compared to control (89.25%). 120 DAS the pooled data revealed that there was no grain damage in treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (12.25%). The next best treatment was sand 10 per cent (74.00%) and it was followed by the treatment of saw dust 10 per cent with 80.88 per cent grain damage. The maximum per cent of grain damage was observed in the treatment of cow dung ash 10 per cent (81.75) as compared to control (96.00%). 150 DAS the pooled data over for per cent grain damage of two years revealed that there was no grain damage in treatments of kaolinite clay 10 per cent followed by

Table 1 : Grain damage due to *Sitophilus oryzae* in sorghum treated with inert materials (pooled of 2007-08 and 2008-09)

Sr. No.	Treatments	Per cent grain damage						
		30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	Mean
1.	Kaolinite clay 10(%)	0.41a 0.00)*	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)
2.	Cow dung ash 10(%)	45.41d (50.75)	55.15c (67.38)	60.22d (75.25)	64.72d (81.75)	66.43d (84.00)	70.61d (89.00)	59.43d (74.69)
3.	Sawdust 10(%)	42.46c (45.63)	56.46d (69.50)	58.68d (73.00)	64.07d (80.88)	67.42d (85.25)	74.13e (92.50)	59.44d (74.46)
4.	Sand 10(%)	37.07b (36.38)	51.78b (61.75)	54.62c (66.50)	59.33c (74.00)	61.69c (77.50)	67.87c (85.75)	54.39c (66.98)
5.	Bentonite 10(%)	0.41a (0.00)	0.41a (0.00)	16.91b (8.50)	20.47b (12.25)	22.05b (14.13)	25.98b (19.25)	14.37b (9.02)
6.	Control	52.60e (63.13)	59.32e (74.00)	70.87e (89.25)	78.48e (96.00)	86.89e (99.38)	89.56f (100.00)	68.90e (86.96)
	S.E. ±	0.98	0.25	0.56	0.43	0.62	0.44	1.49
	C.D. (P = 0.05)	3.56	0.72	1.61	1.24	1.77	1.25	4.24
	T X Y							
	S.E. ±	0.58	0.72	0.85	0.64	0.88	0.65	0.68
	C.D. (P = 0.05)	1.68	NS	NS	NS	NS	NS	2.03
	CV(%)	3.93	1.99	3.89	2.68	3.45	2.35	3.10

NS = Non-significant * Figures in the parentheses are original values and those outside the parentheses are arcsine transformed values

bentonite 10 per cent (14.13%). Third best treatment was sand 10 per cent with 77.50 per cent grain damage and it was followed by the treatment of cow dung ash 10 per cent (84.00%). The maximum per cent of grain damage was observed in the treatment of saw dust 10 per cent with 85.25 per cent over the control (99.38%). While 180 DAS there was no grain damage in treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (19.25%). The next best treatment was sand 10 per cent (85.75%) and it was followed by the treatment of cow dung ash 10 per cent with 89.00 per cent grain damage. The maximum per cent of grain damage was observed in the treatment of saw dust 10 per cent (92.50) as compared to control (100.00%).

Thus, overall conclusion from the study on inert materials against *S. oryzae* on sorghum can be drawn that most effective inert material was kaolinite clay 10 per cent, which recorded no grain damage and bentonite clay 10 per cent recorded 9.02 per cent grain damage. Whereas, the treatment of sand 10 per cent (66.98%), saw dust 10 per cent (74.46%) and cow dung ash 10 per cent (74.69%) were found least effective in preventing the grain damage. However, all the treatments gradually lost their effectiveness with the increase of the period of grain storage (Fig. 1). The present findings are supported by the Yevoor (2003) work stated that kaolinite 10 per cent caused up to 90 per cent mortality of adult at 28 days after release and less per cent grain damage and weight loss up to 90 DAS.

Per cent weight loss due to *Sitophilus oryzae* in sorghum treated with inert materials :

The data on pooled for per cent weight loss of two years 2007-08 and 2008-09 (Table 2) revealed that there was no weight loss in treatments of kaolinite clay 10 per cent and bentonite 10 per cent 30 DAS. While, second best treatment was sand 10 per cent (2.38%). The maximum per cent of weight loss was observed in the treatment of cow dung ash 10 per cent (6.75%) and it was at par with the treatment of sawdust 10 per cent (6.63%) as compared to control (24.13%). 60 DAS the pooled data revealed that there was no weight loss in the treatments of kaolinite clay 10 per cent and bentonite 10 per cent. Second best treatment was sand 10 per cent with 17.75 per cent weight loss. The maximum per cent of weight loss was observed in the treatment of saw dust 10 per cent with 25.50 and it was followed by the treatment of cow dung ash 10 per cent having 23.38 per cent weight loss as compared to control (35.00%). 90 DAS pooled data indicate that there was no weight loss in treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (3.45%). Second best treatment was sand 10 per cent with 22.50 per cent weight loss. The maximum per cent of weight loss was observed in cow dung ash 10 per cent (31.25%) and it was followed by the treatment of saw dust 10 per cent having 29.00 per cent weight loss as compared to control (50.25%). The pooled data for per cent weight loss of two years, 120 days after storage revealed that there was no weight loss in treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (7.25%). Second best treatment was sand 10 per cent with 30.00 per cent weight loss. The maximum per cent of weight loss was observed in the treatment of cow dung ash 10 per cent (37.75%) and it was followed by the treatment of saw dust 10 per cent having 36.88 per cent weight loss as compared to control (57.00%). 150 DAS the pooled data revealed that there was no weight loss in treatments of kaolinite clay 10 per cent followed by bentonite 10 per cent (8.11%). Second best treatment was sand 10 per cent with 33.50 per cent weight loss. The maximum per cent of weight loss was observed in the treatment of saw dust 10 per cent (41.25%) and it was at par with the treatment of cow dung ash 10 per cent having 40.00 per cent weight loss as compared to control (60.38%). While 180 DAS the pooled data revealed that there was no weight loss in treatments of kaolinite

Table 2 : Per cent weight loss due to *Sitophilus oryzae* in sorghum treated with various inert materials (pooled of 2007-08 and 2008-09)

Sr. No.	Treatments	Per cent weight loss						
		30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	Mean
1.	Kaolinite clay 10(%)	0.41a (0.00)*	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)	0.41a (0.00)
2.	Cow dung ash 10(%)	15.12d (6.75)	28.93c (23.38)	34.02e (31.25)	37.94e (37.75)	39.23d (40.00)	42.13d (45.00)	33.65d (30.69)
3.	Sawdust 10(%)	14.89c (6.63)	30.33d (25.50)	32.58d (29.00)	37.41d (36.88)	39.99e (41.25)	44.14e (48.50)	34.02d (31.29)
4.	Sand 10(%)	8.91b (2.38)	24.95b (17.75)	30.33c (22.50)	33.21c (30.00)	35.37c (33.50)	40.28c (41.75)	29.80c (24.65)
5.	Bentonite 10(%)	0.41a (0.00)	0.41a (0.00)	10.63b (3.45)	15.56b (7.25)	16.54b (8.11)	20.18b (11.92)	12.95b (5.12)
6.	Control	29.40e (24.13)	36.27e (35.00)	45.17f (50.25)	49.02f (57.00)	50.94f (60.38)	51.35f (61.00)	43.80e (47.96)
	S.E. ±	0.12	0.14	0.14	0.15	0.13	0.14	0.34
	C.D. (P=0.05)	0.35	0.51	0.39	0.43	0.38	0.41	0.95
	T X Y							
	S.E. ±	0.17	0.09	0.19	0.22	0.19	0.21	0.18
	C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	0.54
	CV(%)	3.38	1.66	3.43	3.59	2.94	2.71	3.03

NS = Non-significant

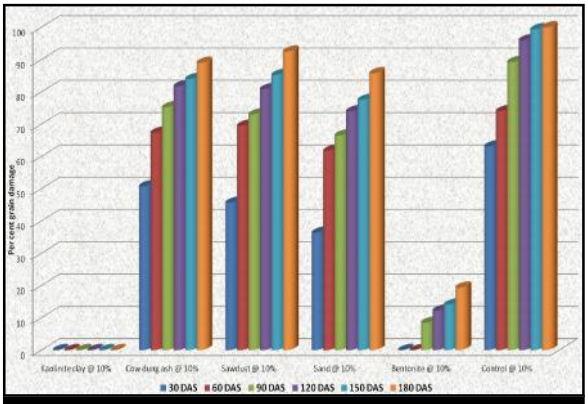

Fig. 1 : Per cent grain damage due to *S. oryzae* in sorghum treated with inert materials (Pooled)

clay 10 per cent followed by bentonite 10 per cent (11.92%). Third best treatment was sand 10 per cent with 41.75 per cent weight loss. The maximum per cent of weight loss was observed in the treatment of saw dust 10 per cent (48.50%) and it was at par with the treatment of cow dung ash 10 per cent having 45.00 per cent weight loss as compared to control (61.00%).

Thus, overall conclusion from the study on inert materials against *S. oryzae* on sorghum can be drawn that most effective inert materials was kaolinite clay 10 per cent recorded no weight loss. While, bentonite clay 10 per cent stood second with 5.12 per cent weight lost. Whereas the treatment of sand 10 per cent (24.65%), cow dung ash 10 per cent (30.69%) and saw dust 10 per cent (31.29%) were found least effective in preventing the weight loss. However, all the treatments gradually lost their effectiveness with the increase of the period of grain storage (Fig. 1). Earlier worker, Yevoor (2003), also reported that kaolinite 10 per cent caused up to 90 per cent mortality of adult at 28 days after release and less per cent grain damage and weight loss up to 90 DAS. While saw dust 10 per cent was not effective in controlling rice weevil damage to maize grains.

Summary :

The overall conclusion from the study on inert materials against *S. oryzae* on sorghum can be drawn that most effective inert materials was kaolinite clay 10 per cent, which recorded no grain damage and bentonite clay 10 per cent (9.02%). Whereas, the treatment of sand 10 per cent (66.98%), saw dust 10 per cent (74.46%) were and cow dung ash 10 per cent (74.69%) found least effective in preventing the grain damage. While in case of weight loss, most effective inert materials was kaolinite clay 10 per cent that recorded no weight loss. While, bentonite clay 10 per cent stood second with 5.12 per cent weight lost. Whereas the treatment of sand 10 per cent (24.65%), cow dung ash 10 per cent (30.69%) and saw dust 10 per cent (31.29%) were found least effective in preventing the weight loss. However, all the treatments gradually lost their effectiveness with the increase of the period of grain storage.

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