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Research Article

Efficacy of inert dusts as grain protectant against *Rhyzopertha dominica* infesting stored wheat

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ABSTRACT : The different inert dusts *viz*, fly ash, cow dung cake ash, rice husk ash, diatomaceous earth @ 5g /kg seed alone or in combination with desiccant ($MgSO_4$) 5g/kg seed were compared with deltamethrin 2.5 WP @ 40mg/kg seed and untreated control against major storage insect pest infestating wheat seed. The observation on germination and insect infestation were recorded at interval of three months of storage period. Among different inert dusts and insecticide, seed treatment of deltamethrin 2.5 WP@ 40 mg/kg and diatomaceous earth+ desiccant ($MgSO_4$) each 5 g/kg seed were found most promising in preventing seed damage and maintained higher seed germination than MSCS (85 %) for the storage period of 9 months.

KEY WORDS : Diatomaceous earth, Storage, Wheat, *Rhyzopertha dominica*

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INTRODUCTION

Wheat is one of the most widely used staple foods in the world of agriculture. Among the wheat growing countries of the world, India ranks second both in area and production. Being an important cereal, wheat is stored by the farmers and government agencies for its utilization throughout the year in different parts of the country. Use of quality seed is the most essential basic input in crop protection as this helps in maintaining require plant population per unit area. After harvest, the seed are stored for different period for sowing in next season. Besides production constraints the insect pest problem, improper sanitation and storing methods cause both qualitative and quantitative losses in wheat. In storage the losses are mainly due to insects, mites and pathogens. The presence of insects in stored products has always posed unique problems. Nearly 10 per cent of the grain stored after each harvest is believed to be lost due to ravages of rats, insects, mites and microbial agents (Walter, 1971). The average loss of food grains in storage due to biotic and abiotic factors accounts for 10 per cent per year, out of which insects are contributing about 2.5 to 5.0 per cent. Survey conducted by Food and Agriculture Organization revealed that lesser grain borer, *R. dominica* is the major pest of wheat, rice and millets in India (Champ and Dyte, 1977).

Its attack is normally noticed when considerable damage is already done. Prevention of loss in stored products due to insects is of most important. Insecticides when properly used will continue to play an important role in reducing the storage losses due to insect pests, but the indiscriminate use of insecticides has posed several problems like residual toxicity, resistance development and environmental hazards. There is a need to find the alternatives to the chemicals that can effectively prevent the storage losses, safer to the human beings and least detrimental to environment.

This approach could be achieved by exploiting use of

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different inert dust material in storage. Synthetic dusts are effective in controlling pests of stored pulses and cereals and are used commercially in developed countries (Golob, 1997). In recent years diatomaceous earth has been identified as replacement for conventional insecticides. Diatomaceous earth is the fossil remains of diatom skeletons. It disrupts the epicuticle by absorption of lipids and insects are more vulnerable to desiccation once they lose the protection of the water proof layers. Very little research work on the storage of cereal and pulses using diatomaceous earth has been carried out. Cook and Armitage (2003), Christos *et al.* (2005) and Korunic and Mackay (1999) tried the efficacy of diatomaceous earth at different concentrations against storage pests of wheat. In view of the encouraging results obtained by above workers, the effectiveness of diatomaceous earth and other inert dust material were estimated against *R. dominica* infesting wheat seed.

EXPERIMENTAL METHODS

A laboratory experiment conducted at Seed Technology Research Unit. MPKV, Rahuri for three consecutive years from 2009-2010, 2010-2011 and 2011-2012 in completely randomized design having ten treatments and three replications. Different inert dusts *viz*, fly ash, cow dung cake ash, rice husk ash and diatomaceous earth 5g each/ kg seed alone and in combination with desiccant (5g $MgSO_4$/kg seed) were compared with deltamethrin 2.5 WP @ 40 mg/kg seed and untreated control. Freshly harvested 1 kg certified wheat seed (HD-2189) with very high germination percentage and low moisture content was taken for each treatment. Required quantity of inert dust to treat one kg of seed and deltamethrin 2.5 WP was diluted in 10ml of water for proper coating. After drying in shade, seeds were packed in 2 kg capacity gunny bag lets and kept in storage under ambient conditions. Observations on germination, insect infestation were recorded at an interval of every three months during the storage period. Germination was determined as per ISTA rules (Anonymous, 1985). Insect infestation was carried out by counting damaged seed. The statistical analysis was done by using completely randomized design (CRD).

EXPERIMENTAL RESULTS AND ANALYSIS

The germination test of different inert dust were carried out and compared with deltamethrin and untreated control and pooled data (2009-10 to 2011-12) on germination percentage are presented in Table1. It is clear from the data that there was no significant difference in germination up to three months of storage. However data on 6th and 9 month after storage revealed significant difference among the different seed treatments. At 6 month storage all the treatments recorded significantly higher germination (above MSCS *i.e.* 85 %) compared to untreated control (83.67 %). The wheat seed treated with deltamethrin 2.5 WP @ 40 mg/kg seed recorded significantly higher seed germination (89.67%) and remained at par with remaining treatments except fly ash (85.67 %), rice husk (85.67 %) and untreated control (83.67 %). Similarly at 9 month after storage deltamethrin 2.5 WP @ 40 mg/kg seed recorded significantly highest germination (87.67%) and was at par with diatomaceous earth+ desiccant ($MgSO_4$) each 5 g/kg seed (87.00%). Further among different treatments only deltamethrin and diatomaceous earth maintained the seed germination above MSCS (85 %). The decreasing in germination in all treatment during storage period was plausibly aging effect.

The data pertaining to seed infestation percentage due to different treatment during 9 month of storage period are presented in Table 2. The initiation of seed infestation was noticed from 3 months onward irrespective of seed treatments.

Table 1: Performance of different inert dusts on wheat seed germination (Pooled data 2009 to 2012)

Sr. No.	Treatments	0 Month	3 Month	6Month	9 Month
1.	Fly ash @5g/kg seed	94.33 (76.59)	89.89 (71.66)	85.67 (67.77)	81.67 (65.07)*
2.	Fly ash @ 5g/kg seed+ Desiccant #	93.67 (75.67)	91.00 (72.62)	86.67 (68.64)	84.00 (66.93)
3.	Cow dung cake ash @5g/kg seed	93.67 (75.73)	90.44 (72.11)	87.00 (68.89)	81.00 (64.42)
4.	Cow dung cake ash @5 g/kg Seed + Desiccant	93.67 (75.56)	91.44 (73.11)	87.33 (69.19)	83.00 (65.92)
5.	Rice husk ash @ 5g/kg seed	94.00 (76.15)	89.33 (71.02)	85.67 (67.80)	81.22 (64.47)
6.	Rice husk ash @5 g/kg seed + Desiccant	94.33 (76.79)	90.33 (71.98)	86.67 (68.69)	84.33 (67.03)
7.	Diatomaceous earth @5 g/kg seed	94.00 (76.26)	91.00 (72.59)	87.78 (69.58)	85.00 (67.45)
8.	Diatomaceous earth @5 g/kg seed+ Desiccant	93.67 (75.69)	92.33 (74.00)	89.33 (70.98)	87.00 (68.65)
9.	Deltamethrin 2.5 WP @ 1 ppm (40 mg/kg seed)	94.44 (76.73)	92.00 (73.66)	89.67 (71.32)	87.67 (69.13)
10.	Untreated control	94.00 (76.09)	87.67 (69.51)	83.67 (66.18)	78.67 (62.88)
	S.E. ±	1.28	1.06	1.03	0.45
	C.D. (P=0.05)	NS	NS	2.93	1.31
	C.V. (%)	2.91	2.54	2.61	-

Figures in parenthesis are arcsine transformed values * Wt. mean NS=Non-significant

Table 2 : Performance of different inert dusts on wheat seed infestation (Pooled data 2009 to 2012)

Sr. No.	Treatments	0 Month	3 Month	6Month	9 Month
1.	Fly ash @5g/kg seed	0	1.33 (6.22)	2.44 (8.86)	4.67 (12.42)
2.	Fly ash @ 5g/kg seed+ Desiccant #	0	0.78 (4.26)	1.33 (5.91)	2.78 (9.53)
3.	Cow dung cake ash @5g/kg seed	0	1.44 (5.74)	2.78 (8.78)	4.56 (12.00)
4.	Cow dung cake ash @5 g/kg Seed + Desiccant	0	1.00 (4.79)	1.89 (6.87)	3.22 (10.12)
5.	Rice husk ash @ 5g/kg seed	0	2.22 (8.33)	3.89 (11.24)	6.00 (14.10)
6.	Rice husk ash @5 g/kg seed + Desiccant	0	1.22 (5.96)	2.33 (8.45)	3.89 (11.24)
7.	Diatomaceous earth @5 g/kg seed	0	0.00 (0.51)	0.67 (3.68)	2.00 (7.63)
8.	Diatomaceous earth @5 g/kg seed+ Desiccant	0	0.00 (0.51)	0.00 (0.51)	0.33 (2.25)
9.	Deltamethrin 2.5 WP @ 1 ppm (40 mg/kg seed)	0	0.00 (0.51)	0.00 (0.51)	0.33 (2.25)
10.	Untreated control	0	7.33 (15.46)	13.33 (21.10)	20.22 (26.63)
	S.E. ±	-	1.00	1.28	1.02
	C.D. (P=0.05)	-	2.82	3.63	3.04
	C.V. (%)	-	32.99	29.29	16.41

$MgSO_4$. Figures in parenthesis are arcsine transformed values * Wt. mean

At three month storage all the treatments were found significantly superior over control in preventing seed damage. The seed treatment with deltamethrin 2.5 WP @ 40 mg/kg and diatomaceous earth alone and combination with desiccant ($MgSO_4$) each 5 g/kg seed were found most promising, giving complete protection of seed of wheat up to 3 months after treatment. More or less similar trend of efficacy was observed at 6 month storage. At 9 month storage the treatment of deltamethrin 2.5 WP @ 40 mg/kg and diatomaceous earth+ desiccant ($MgSO_4$) each 5 g/kg seed recorded least seed infestation (0.33 %). The maximum seed infestation was recorded in untreated control (20.22 %). These finding in respect of diatomaceous earth are in agreements with Jane *et al*. (2011) they reported effectiveness of diatomaceous earth 5g/kg seed in reducing insect infestation of stored sorghum. The effectiveness of different formulation of diatomaceous earth against stored grain pest of wheat was also reported by Strong and Sbur (1963) and Christos *et al*. (2005).The superiority of diatomaceous earth alone and with desiccant and deltamethrin over insecticides and inert dusts were recorded at various centre of National Seed Project (Anonymous, 2012).

Thus the present investigation revealed that the wheat seed treatment of deltamethrin 2.5 WP @ 40 mg/kg and diatomaceous earth+ desiccant (MgsO4) each 5 g/kg seed was found effective for maintaining the insect infestation below ETL (0.50 per cent) and higher seed germination than MSCS (85 %) for the storage period of 9 months.

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