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Effects of Storage Period and Insecticidal Dusts on Wheat Seed Quality

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ABSTRACT Six insecticidal dusts viz., fenvalerate 0.4D, methyl parathion 2D, endosulfan 4D, quinalphos 1.5D, malathion 5D and carbaryl 5D each @ 1.5, 2.5 and 3.5g/kg seed were mixed with wheat (cv. Raj-3765) seeds to evaluate their effect on seed quality up to 180 days under ambient storage conditions at Hisar. Fenvalerate 0.4D, malathion 5D and endosulfan 4D did not adversely effect the germination, whereas methyl parathion 2D and quinalphos 1.5 D (both @ 2.5 and 3.5g/kg seed) deteriorated the seed germination. All the doses of carbaryl 5D were comparable to untreated seeds for standard germination. Seedling vigour improved by fenvalerate 0.4D, endosulfan 4D and malathion 5D treatments, whereas all the doses of methyl parathion 2D, quinalphos 1.5D and carbaryl 5D reduced vigour as compared to control. Storage period of insecticide treated seed had linear relationship with deterioration of seed quality.

Key words: Wheat, insecticidal treatment, seed germination, seedling vigour

For achieving higher productivity, use of quality seed leading to high germination is essential. After harvest and threshing, wheat seeds have to be stored for different periods before these are actually used for sowing in the next season. Wheat (Triticum aestivum L.) seeds are damaged mainly by insect-pests, rodents, mites and micro-organisms during storage. Among the insect-pests, khapra beetle, [Trogoderma granarium (Everts)] is the most serious pest of stored wheat seed [1]. This insect causes huge losses, if the proper control measures are not adopted. In Haryana, mixing of malathion 5D @ 250g/q seed is one of the recommendations for safe storage of wheat seed [2]. Since, there is a report of resistance to this chemical [3], the present investigations were conducted to evaluate their effect on the quality of wheat seed.

MATERIALS AND METHODS

Foundation seed of wheat cv. Raj-3765 was procured from Directorate of Farms, CCS Haryana Agricultural University, Hisar. Insecticidal dusts were mixed with the wheat seeds in a round bottom flask. For each treatment, manual shaking was done for 10 minutes. Different insecticides were mixed for various doses viz., 1.5, 2.5 and 3.5g/kg seed. The untreated seeds were taken as control. Each treatment was replicated thrice.

Seed quality test

One kg of treated as well as untreated seeds with various insecticidal dusts at different doses in three replicates were stored in 2.0 kg gunny bag under normal storage conditions up to a period of 180 days.

i) **Germination (%):** Samples of 100-seeds from all the replicated treatments were drawn at random after 1, 60, 120 and 180 days of storage and were tested for germination between the paper towel following ISTA rules [4].

ii) **Seedling vigour index-I:** From each replication, five normal seedlings were selected randomly at the end of germination test and the seedling length (root + shoot length) was measured. Average seedling length was calculated. The seedling vigour index-I was computed by following formula.

$$\text{Vigour index I} = \text{Germination (\%)} \times \text{Average seedling length (cm)}$$

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iii) **Seedling vigour index-II:** The aforesaid five seedlings were placed in the paper envelope and dried under shade for one day. These were then placed in oven (70°- 80°C) for 48 hours and then weighed to determine average seedling dry weight (mg) in each replication. The vigour index-II was calculated by following formula:

Vigour index II = Germination (%) x Average seedling dry weight

RESULTS AND DISCUSSION

Germination (%)

Irrespective of storage period, treatment of seeds with quinalphos 1.5D @ 3.5 g/kg seed resulted with a minimum (92.50%) germination which was followed by seed treatment with-methyl parathion 2D @ 3.5 g/kg seed (93.00%) table 1. The germination in untreated seed was 95.5 per cent which was at par with germination in quinalphos 1.5D @ 1.5 g/kg seed and all the treatments of carbaryl i.e., 1.5, 2.5 and 3.5 g/kg seed. Seed treatment with methyl parathion 2D and quinalphos 1.5 D (@ 2.5 & 3.5 g/kg seed) reduced the germination, as compared to untreated control. Maximum seed germination (97.00%) was recorded when fenvalerate 0.4D (@ 1.5 g/kg seed) was mixed with seed. This was followed by seed treatment with fenvalerate 0.4D (@ 3.5 g/kg) and endosulfan @ 2.5 and 3.5 g/kg seed. Across the insecticides, the standard germination at different storage periods was found to decrease linearly, it being maximum (95.63%) at 1 DFS to minimum (94.31%) at 180 DFS.

Interaction between insecticidal treatments and storage periods showed minimum (91.00%) germination in quinalphos 1.5D (@ 3.5 g/kg seed) at 120 DFS. This was closely followed (92.00%) by seed treatment with quinalphos @ 3.5 g/kg seed at 60 DFS and @ 2.5 g/kg seed at 120 DFS; methyl parathion @ 2.5 g/kg seed at 120 and 180 DFS and also @ 2.5 g/kg seed at 180 DFS. However, seed treatment with fenvalerate 0.4D @ 1.5 and 3.5 g/kg seed (60 DFS) resulted in max (98%) seed germination. This was followed by fenvalerate 0.4D(1.5 g/kg seed) at 1 and 120 DFS, endosulfan 4D (@ 2.5 and 3.5 g/kg seed) at 120 and 1.0 DFS,

Table 1. Effect of storage periods on mixing insecticidal dust with seeds on germination of wheat

Insecticidal dusts (g/kg of seeds)	Germination (%) at DFS*				
	1	60	120	180	Mean
Fenvalerate 0.4D					
1.5	97.00**	98.00	97.00	96.00	97.00
2.5	96.00	96.00	95.00	95.00	95.50
3.5	96.00	98.00	96.00	95.00	96.25
Methyl parathion 2D					
1.5	94.00	93.00	95.00	94.00	94.00
2.5	95.00	93.00	94.00	92.00	93.50
3.5	94.00	94.00	92.00	92.00	93.00
Endosulfan 4D					
1.5	96.00	96.00	95.00	95.00	95.50
2.5	96.00	96.00	97.00	96.00	96.25
3.5	97.00	96.00	96.00	96.00	96.25
Quinalphos 1.5D					
1.5	96.00	94.00	95.00	94.00	94.75
2.5	96.00	94.00	92.00	93.00	93.75
3.5	95.00	92.00	91.00	92.00	92.50
Malathion 5D					
1.5	96.00	96.00	96.00	95.00	95.75
2.5	96.00	96.00	96.00	95.00	95.75
3.5	96.00	96.00	96.00	95.00	95.75
Carbaryl 5D					
1.5	96.00	94.00	94.00	95.00	94.75
2.5	95.00	95.00	94.00	94.00	94.50
3.5	95.00	95.00	95.00	94.00	94.75
Control (untreated)	95.00	96.00	94.00	94.00	94.75
Mean	95.63	95.16	94.68	94.31	
CD at 5% for Insecticidal dust = 0.31 DFS = 0.25 Insecticidal dust x DFS = 0.62					

*Days from storage; **Mean value of 300 seeds (100-seeds in each of three replicates)

respectively and carbaryl 5D (@ 1.5 g/kg seed) at 1 DFS and these were significantly higher than all treatments including control at all storage periods. The results obtained in present study showed that insecticidal dusts and storage periods of treated seeds had significantly effect on per cent germination. Fenvalerate 0.4D, endosulfan 4D, malathion 5D and carbaryl 5D did not have

adverse effect on the germination, however methyl parathion 2D, quinalphos 1.5D (both @ 2.5 and 3.5 g/kg seed) had deleterious effect on wheat germination as compared to untreated control.

The wheat seed germination has not been found to be adversely affected by mixing carbaryl @ 500 and 100 ppm with soil, while carbaryl @ 2500 and 5000 ppm markedly decreased germination [5]. Wheat grains treatment for 3 hrs with 0.1 per cent solution of quinalphos (ekalux) reduced the germination [6]. After a storage period of six months, the germination of wheat seeds treated with malathion (50 ppm) was significantly higher than that of untreated seeds and malathion even @ 250 ppm had no adverse effect on germination of wheat seeds [7].

Seedling vigour index

The data (Table 2) showed that irrespective of storage period, the minimum (2439.70) seedling vigour index-I was recorded when seeds were mixed with methyl parathion 2D (3.5 g/kg seed). In contrast, maximum (2983.17) seedling vigour index-I was recorded with fenvalerate 0.4D (3.5 g/kg seed) and it was at par with fenvalerate 0.4D (@ 1.5 & 2.5 g/kg seed) having/seedling vigour index-I of 2962.90 and 2892.77, respectively. All the treatments of fenvalerate 0.4 D and malathion 5D were significantly superior to untreated seeds. Irrespective of insecticidal dusts, minimum (2583.08) seedling vigour index-I was recorded at 180 DFS. Maximum (2784.51) seedling vigour index-I was recorded at 60 DFS which did not differ significantly with seedlings vigour index-I at 1 DFS and 120 DFS. The interaction between insecticidal dusts and storage periods showed minimum (2125.2) seedling vigour index-I when seeds were mixed with methyl parathion 2D (@ 2.5 g/kg seed at 180 DFS which was at par with methyl parathion 2D (1.5 and 3.5 g/kg seed) at 180 DFS. Maximum (3361.4) seedling vigour index-I was recorded with fenvalerate 0.4 D (@ 3.5 g/kg seed) at 60 DFS. The results of the present study showed that fenvalerate 0.4D, malathion 5D and endosulfan 4D had higher seedling vigour index-I as compared to the control, whereas, the doses of methyl parathion 2D, quinalphos 1.5D and carbaryl 5D showed significantly lower seedling vigour index-I as compared to untreated seeds. The data (Table 3) irrespective of storage periods, show that methyl parathion 2D (@ 3.5g/kg seed) resulted in minimum (1204.90) seedling vigour index-II. However, fenvalerate 0.4D (@ 2.5g/kg seed) gave maximum (1745.15) seedling vigour index-II. All the doses of fenvalerate 0.4D, malathion 5D and endosulfan 4D were significantly superior than that of control

Table 2. Effect of storage periods and mixing insecticidal dusts with seeds on seedling vigour index-I of wheat

Insecticidal dust (g/kg of seeds)	Seedling vigour index-I at DFS*				
	1	60	120	180	Mean
Fenvalerate 0.4D					
1.5	2871.2	2930.2	2900.3	2966.4	2892.77
2.5	2841.6	3120.0	3011.5	2878.5	2962.90
3.5	2774.4	3361.4	2918.4	2878.5	2983.17
Methyl parathion 2D					
1.5	2716.6	2622.6	2650.5	2152.6	2535.57
2.5	2679.0	2585.4	2622.6	2125.2	2503.05
3.5	2575.6	2500.4	2520.8	2162.0	2439.70
Endosulfan 4D					
1.5	2707.2	2870.4	2793.0	2660.0	2757.65
2.5	2764.8	2793.6	2822.7	2841.6	2805.67
3.5	2706.3	2803.2	2832.0	2736.0	2769.37
Quinalphos 1.5D					
1.5	2707.2	2744.8	2783.5	2491.0	2681.62
2.5	2774.4	2726.0	2585.2	2250.6	2584.05
3.5	2669.5	2502.4	2611.7	2520.8	2576.10
Malathion 5D					
1.5	2726.4	2755.2	2880.0	2745.0	2800.50
2.5	2937.6	2899.2	2859.5	2774.0	2867.57
3.5	2726.4	2755.2	2880.0	2745.5	2800.65
Carbaryl 5D					
1.5	2620.8	2669.6	2688.4	2574.4	2638.30
2.5	2755.0	2641.0	2660.2	2547.4	2650.90
3.5	2726.5	2774.0	2726.6	2444.0	2667.00
Control (untreated)	2736.0	2851.2	2801.2	2585.0	2743.35
Mean	2737.71	2784.51	2765.69	2583.08	
CD at 5% for Insecticidal dusts = 92.32 DFS = 75.38 Insecticidal dusts x DFS = 184.65					

*Days from storage

Table 3. Effect of storage periods and mixing insecticidal dust with seeds on seedling vigour index-II of wheat

Insecticidal dusts (g/kg of seeds)	Seedling vigour index-II at DFS* 1	60	120	180	Mean
Fenvalerate 0.4D					
1.5	1687.8	1783.6	1707.2	1612.8	1697.85
2.5	1584.0	1881.6	1814.5	1700.5	1745.15
3.5	1660.8	2038.4	1651.2	1539.0	1631.35
Methyl parathion 2D					
1.5	1579.2	1385.7	1444.0	1297.2	1418.92
2.5	1292.0	1395.0	1438.2	1426.0	1387.80
3.5	1316.0	1222.0	1168.4	1113.2	1204.90
Endosulfan 4D					
1.5	1699.2	1660.8	1558.0	1529.5	1611.87
2.5	1612.8	1545.6	1649.0	1536.0	1585.85
3.5	1571.4	1574.4	1612.8	1555.2	1581.72
Quinalphos 1.5D					
1.5	1526.4	1551.0	1501.0	1372.4	1487.70
2.5	1593.6	1419.4	1481.2	1422.9	1479.27
3.5	1596.0	1582.4	1474.2	1380.0	1508.15
Malathion 5D					
1.5	1603.0	1612.7	1680.0	1633.8	1632.00
2.5	1717.4	1641.6	1643.5	1596.0	1649.87
3.5	1603.2	1612.8	1680.0	1634.0	1632.50
Carbaryl 5D					
1.5	1564.8	1598.0	1485.2	1444.0	1523.00
2.5	1520.0	1510.5	1560.4	1400.6	1497.87
3.5	1539.0	1586.5	1624.5	1466.4	1554.10
Control (untreated)	1643.5	1622.4	1522.8	1513.4	1575.32
Mean	1574.26	1590.75	1562.95	1482.78	
CD at 5% for Insecticidal dusts = 42.55 DFS = 34.74 Insecticidal dusts x DFS = 85.11					

*Days from storage

whereas, all treatments of methyl parathion 2D, quinalphos 1.5 D and carbaryl 5D were significantly lower than control. Irrespective of insecticidal dusts, minimum vigor index-II (1482.78) was recorded at 180 DFS. In contrast maximum (1590.75) at 60 DFS followed by 1 DFS (1574.26) and 120 DFS (1562.95). Interaction between insecticidal dusts and storage periods resulted with minimum vigour index-II (1113.00) in methyl parathion 2D (@ 3.5g/kg seed) at 180 DFS, which was at par with methyl parathion 2D (@ 3.5g/kg seed) at 120 DFS. Maximum vigour index-II (2038.4) was recorded at 60 DFS when seeds were mixed with fenvalerate 0.4D (3.5g/kg seed). The results of present study showed that fenvalerate 0.4D and malathion 5D increased seedling vigour index-II as compared to control. Whereas, endosulfan 4D and carbaryl 5D did not differ significantly as compared to control. Cowpea seeds treated with malathion 5D and 10D each @ 10g/kg showed a significant increase in germination, root and shoot length, dry weight and seedling vigour index over untreated seeds [8]. Since admixing of malathion 5D @ 250 g/q wheat seed has shown resistance to the target pest in seed stores, the study emumarate the potential insecticides, which can replace the earlier recommendations without affecting the seed quality up to 180 days from storage.

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