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EFFECT OF STORAGE PERIOD, SEED MOISTURE CONTENT AND INSECTICIDES TREATMENT ON WHEAT (*Triticum aestivum L.*) SEED QUALITY.

BY

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ABSTRACT

Seed moisture content, insecticides treatment and storage period were the main factors affecting wheat seed quality as measured by germination percentage, seedling vigour traits, insect infestation severity and seed dry weight losses. Laboratory experiments were conducted at Seed Technology Unit Lab. Mansoura, Dakhlia during 2004/2005 season to study the effect of four storage periods (0, 6, 12 and 18 months), three seed moisture contents (12%, 15% and 18%) and eight insecticides seed treatments i.e.(control, malathion 57%, fumigation with phosphine at temperature degrees 30, 35 and 40°C, fumigation at 30, 35 and 40°C + malathion). The results revealed that prolonging storage period and high seed moisture content reduced germinability (as meseared by germination percentage, germination index and germination rate), seedling vigour(plumule, radical lengths, seedling dry weight and its vigour index) and accelcrated seed aging. Meanwhile, increasing storage period and high seed moisture content increased mean germination time, electrical conductivity, insect infestation and dry weight losses of the seed. Treating wheat seed with malathion 57%, fumigation at temperature degrees of 30, 35°C, fumigation at 30°C + malathion did not show harmful effects on seed germination or seedling vigour. On contrast, fumigation at 40°C, fumigation at 35°C + malathion and fumigation at 40°C + malathion had an adverse effect on seed germination and seedlings vigour traits. Treatments with insecticides can protect wheat seed from any insect infestation more than 6 months. The infestation level was slight for 12 months compared with the untreated seeds. All studied traits negatively and significantly correlated with storage periods and seed moisture contents except mean germination time, electrical conductivity, insect infestation % and seed dry weight loss while significant and positive correlations were obtained. Insect infestation had negatively and significantly correlated with all studied traits except for mean germination time and electrical conductivity while significant positive correlations were noticed. The results suggested treating wheat seed with malathion 57%, fumigation with phosphine at 35°C, fumigation at 30°C + malathion without harmful effects on wheat (c.v. Gemmiza 7) seed quality or seedlings vigour provided that the seed moisture content should be ranged between (12-15%).

INTRODUCTION

Seed viability is affected by many factors among them storage conditions, seed moisture content and infestation by storage pests. During storage a high moisture content reduces viability more rapidly because of mold growth, heating, damage aging and greater insect damage, (FAO, 1983). Also (Tipples, 1995) stated that, high grain moisture content is by for the most important factor influcing the deterioration of stored grain and it causes seed to respire at a much faster and promotes active respiration of molds. These effects led to the increase in grain temperature which result in denaturation of proteins, internal browning or blackening of seeds and destruction of seed quality and germination capacity. On the other hand, high seed moisture content, caused rapid increase in number of insects, fumigation with phosphine showed an adverse effect on seed germination at higher moisture content meanwhile this effect was slight in dry seeds, (Abdalla *et al.*, 1984). Furthermore, (Bekheit *et al.*, 1985) listed wheat grains at 15.8% moisture content were completely lost their viability when stored for six months for fumigated or unfumigated grains bags.

Storage pests specially insects damage both of the endosperm and embryo of cereal seeds causing a reduction in germination capacity, it can also infect the seed with harmful fungi since they may carry the spores with them. (Yadava *et al.*, 1968) study the germination of wheat seed damaged by *Sitophilus oryzae L.*, and *Rhizopertha domonica F.* They found that germination due to damage by *Sitophilus oryzae L.*, and *Rhizopertha domonica F.* was significantly affected. Also (Girish *et al.*, 1976) demonstrated that, the actual losses of grain that recorded during storage were mainly due to insect pests, also they reported that the loss in seed viability after storage for 6 months varied from 70 to 22%. Although chemical insecticides have serious drawbacks such as genetic resistance, toxic residues, worker safety, increasing costs of application and decreasing seed viability but several investigators recommended the importance of using chemical insecticides to control the pests of stored grains among them (El-Hamady *et al.*, 1999).

Other investigators studied the effect of malathion against insects in the storage (Joel, 1999), (Riberio *et al.*, 2003), (Bughio and Wilkins, 2004) and (Petar and Ilija., 2006). (Tahir *et al.*, 1992), assessed the toxicity of malathion against *Sitophilus oryzae* they reported that the LD50 were 1.04 mg/cm^2 paper. Also, fumigants such as phosphine is still the most effective for the protection for insect infestation of stored seeds. several investigators recommended the importance of using fumigants to control the insect pests of stored grains among them, (Rajendran and Muthu, 1989), (Attia *et al.*, 1995), (Rajendran and Muralidhran, 2001), (Stephen and Rainer, 2004), (Abramson *et al.*, 2005) and (Patrick *et al.*, 2005). (Bekheit *et al.*, 1983), pointed out no significant reduction in germination percentage, plumule and primary root length when grain fumigated with phosphine at a rate of 20 and 30 gm/ton at 10% grain moisture content meanwhile, at 13.6% and 15.8% significant reduction in these traits were noticed. Furthermore, (Carl and Pan, 2000), listed that, Phosphine leakage and sorption

were both positively related to grain temperature and moisture content. Also repeated fumigation of the same grain reduced the rate at which phosphine sorped into the grain. The aim of this study was to investigate the effect of different seed moisture contents, treatments with malathion, and fumigation with phosphine at different temperature degrees and storage periods on seed viability, seedling vigor and insect infestation in wheat.

MATERIALS AND METHODS

This investigation was carried out at the laboratory of Seed Technology Unit at Mansoura, Dakhlia Governorate during 2004/2005 season to study the effect of seed moisture content, wheat seed chemical treatments(malathion, phosphine fumigation at different temperature degrees and combination of both) on wheat seed viability and seedlings vigour, insect infestation percentage as well as seed dry weight loss after different storage periods. Wheat seed (c.v. Gemmiza 7) were obtained after one month from harvesting wheat crop produced commercially at Dakhlia governorate, the samples were sieved and cleaned from dust, husk or any inert materials. Then they were divided into three portions and seed moisture content was determined according to (A.O.A.C. 1999) for each portion seed moisture content was adjusted to the required moisture levels (12, 15 and 18%) using the technique of (El-Rafie, 1958). Conditioned samples of moisture levels more than (14%) were not kept without treatment more than 3 weeks as recommended by (Swanson, 1941). Pesticides used were Nasrlathion (Malathion 57 Ec: S-1.2-di(ethoxycarbonyl) ethyl 0,0-dimethyl phosphorodithioate Produced by El-Nasr Comp. for intermediate chemicals, Egypt, and Phosphine tablets 3.0 gm produced 1 gm, active ingredient is aluminum phosphide mixed with ammonium carbonate and paraffin. After exposure to the atmosphere the tablets decomposed and release the active substance (pH_3) which has the same specific weight as air and the distributed in the fumigated materials. The samples were divided into eight portions according to seed moisture level and subjected to treatments as follows:-

1- Control (without treatment) 2-Malathion 57%
3-Fumigation with pH_3 at 30°C 4- Fumigation with pH_3 at 35°C
5-Fumigation with pH_3 at 40°C 6- Fumigation at 30°C + Malathion 57%.
7-Fumigation at 35°C + Malathion 57%.
8- Fumigation with pH3 at 40°C + Malathion 57%.

Taking into consideration malathion 57% was sprayed at a concentration 18 ml/ton and wheat seed was fumigated with pH3 at a dose of 3g for 72h. and it aerated for 24 hr. as recommended by the producing company. After that samples were placed in cloth bags and stored under the laboratory conditions. The studied traits were estimated directly, after 6, 12 and 18 months from treatments. Germination percentage was defined according to (ISTA, 1985). Germination index and mean germination time were calculated according to (Alvarado *et al.*, 1987); germination rate defined according to Bartlett, (1937) meanwhile, seedling vigour index was calculated according to (ISTA, 1985). At the final count, ten normal seedlings from each replicate were taken randomly to measure the plumule and radical length in mm, after that, the seedlings were dried in hot-air oven at 85 °C for 12 hours to obtain the seedlings dry weight. Accelerated aging

test and Electrical conductivity were measured according to (ISTA.,1985). Insect infestation percentage was expressed as percent damage seeds according to (Jood *et al.*, 1996). At the end of each storage period the dry weight loss percentage was calculated according to (Dick, 1987). Data collected from these experiments were subjected to analysis of variance as Randomized Complete Block Design as mentioned by (Gomez and Gomez, 1984), and the treated averages were compared by using the least significant differences (LSD) method. correlation's coefficient were computed according to (Svap 1973).

RESULTS AND DISCUSSION

Data in Table (1) show the effect of storage periods, seed moisture content and insecticides on studied traits. Germination percentage significantly reduced with increasing storage periods from 0 to 6, 12 and 18 months. The highest mean (98.0%) was obtained at the first storage period, on the other side, the lowest mean (80.0%) was obtained after 18 months. The same trend was obtained for germination index and germination rate. On contrast, the minimum rang of mean germination time 2.2 day was obtained at the first storage period while the maximum rang of mean germination time 3.1 day was obtained after 18 months from storage. The tallest plumule and radical length 9.9 and 10.4 cm were obtained at the first storage period, while, the shortest length 7.9 and 8.0 cm of plumule and radical were recorded after 18 months from storage. As a result of that seedlings dry weight had the same trend. Results of accelerated aging test listed in the same table and it cleared that, the first storage period had the highest vital seed, meanwhile, the highest poor vital seed were recorded after 18 months from storage. The lowest reading of electrical conductivity (0.070 *µmhos/gm seed*) were recorded at the first storage period on contrast the highest reading (0.117 *µmhos/gm seed*) were recorded after storage with 18 months. The reduction in seed viability and seedlings vigour traits might be due to, with increasing storage periods, wheat seeds might be infested with storage pests(insects and fungi)or might be due to, the increase of some organic compounds in respiration process with increasing storage periods. Similar results reported by (Girish *et al*,. 1976) and (Behkeit *et al.*, 1983). Insect infestation and seed dry weight loss percentage did not recorded initially after treatment meanwhile they recorded 4.80% and 2.93% respectively, after storage with 18 months. It is to be noticed that insect infestation and seed dry weight loss increased with the increase in storage periods (Jood *et al.*, 1996).

Table (1) also showed that the effect of seed moisture content on all the studied traits was significant. Germination percentage, germination index, germination rate and accelerated aging test reached its highest means (97.0%, 24.1, 0.902 and 74.0%), respectively, at 12 % moisture content. Meanwhile these means reduced to (75.0%, 17.5, 0.860 and 50.0%) respectively, with increasing seed moisture level to 18%. On contrast mean germination time increased from 2.5 to 2.7 days with increasing seed moisture content from 12% to 18%. Readings of seedlings vigour i.e. plumule and radical lengths, seedlings dry weight as well as seedlings vigour index reached its highest means (9.7, 10.0 cm, 0.338 g and 1917.7) respectively, at moisture level 12%. On the contrast seedling vigour traits

reduced to their minimum means (7.5, 8.2 cm, 0.274 g and 1251.8) at moisture level 18%. The reduction in seed viability and seedling traits might be due to the increase in respiration rates by increasing seed moisture content during storage especially as it follows with an increase in temperature degrees during storage which cause rapid consuming of some organic compounds in this process or increase in storage pests. These results are agreed with those reported by (Bekheit *et al.*, 1983) and (Tipples, 1995). With respect to insect infestation percentage and seed dry weight loss percentage, the lowest means (0.69% and 0.23%) respectively, were recorded at 12% moisture level. Meanwhile the highest means (3.84% and 2.71%) were recorded at 18 % seed moisture content. Insect infestation increased with increasing seed moisture content while, insect activity increased with increasing seed moisture levels meanwhile, at low levels of seed moisture content insect activity decreased (FAO, 1983).

Table (1): Effect of storage periods, seed moisture content and seed chemical treatments on wheat seed viability, seedlings vigour traits, insect infestation percentage and seed dry weight loss percentage.

Treatment	Germination%	Germ. index	Germination rate	Mean germ. Time (day)	Plumule length(cm)	Radical length(cm)	Seedlings dry wt.(g)	Accelerated aging germination %	Insect infestation %	Seed dry weight loss %	Seedlings vigour index	Electrical conductivity (micro mhos/cm/g)
A-Storage period												
0 months	98.0	29.8	0.966	2.2	9.9	10.4	0.346	77.0	0.96	0.00	1996.4	0.070
6 months	94.0	24.7	0.920	2.4	9.5	10.1	0.339	70.0	0.43	0.28	1848.4	0.075
12 months	85.0	19.3	0.859	2.7	8.4	9.0	0.234	61.0	0.69	1.28	1524.2	0.084
18 months	80.0	15.9	0.777	3.1	7.5	8.0	0.283	53.0	3.84	2.93	1341.7	0.117
LSD 0.05%	0.6	0.5	0.006	0.1	0.1	0.1	0.004	0.7	0.04	0.49	17.7	0.001
B-Moisture content%												
12%	97.0	24.1	0.902	2.5	9.1	10.0	0.338	74.0	0.69	0.23	1917.7	0.081
15%	96.0	22.4	0.880	2.6	9.0	9.7	0.335	70.0	1.01	0.43	1855.9	0.087
18%	75.0	17.5	0.950	2.7	7.5	8.2	0.274	50.0	3.84	2.71	1251.6	0.136
LSD 0.05%	0.8	0.5	0.007	0.1	0.1	0.1	0.004	0.8	0.05	0.10	20.8	0.001
C- Insecticides treatment												
1-Control	91.0	22.3	0.931	2.5	8.8	9.3	0.310	66.0	0.55	3.07	1689.8	0.092
2-Malathion	91.0	23.4	0.902	2.5	9.1	9.5	0.318	67.0	0.55	0.91	1734.6	0.087
3-Fumig.at 30C	91.0	24.1	0.909	2.5	9.0	9.5	0.318	66.0	0.78	0.85	1726.2	0.078
4-Fumig.at 35C	90.0	22.0	0.886	2.6	9.0	9.4	0.317	65.0	0.80	0.84	1692.5	0.085
5-Fumig.at 40C	89.0	20.2	0.868	2.7	8.9	9.3	0.316	64.0	1.25	0.83	1650.8	0.080
6-Fumig.at 30C+Malathion	90.0	21.0	0.873	2.6	9.0	9.4	0.317	66.0	0.78	0.83	1694.0	0.087
7-Fumig.at 35C+Malathion	88.0	20.0	0.863	2.7	9.0	9.2	0.315	63.0	0.77	0.83	1626.3	0.085
8-Fumig.at 40C+Malathion	86.0	18.3	0.851	2.7	8.8	9.1	0.315	63.0	1.26	0.82	1587.2	0.090
LSD 0.05%	1.0	0.4	0.005	0.1	0.1	0.1	0.004	0.7	0.08	0.83	19.3	0.001

Significantly effects were found for the chemical insecticides on the studied traits are presented in Table (1). The highest mean values of germination

percentage (91.0% and 90.0%) were obtained from untreated seed, treating wheat seed with malathion, fumigation at 30°C, fumigation at 35 °C and fumigation at 30°C + malathion without significant differences between them. On the other side, the lowest means 89.0, 88.0 and 86.0% were obtained from fumigated seed at 40°C, at 35°C + malathion and fumigated at 40°C + malathion. The highest mean of germination index 24.1 was obtained from fumigated seed at 30°C Meanwhile the lowest mean 18.3 was obtained from fumigated seed at 40°C + malathion. The same trends were recorded for plumule length, radical length, seedlings dry weight, seedlings vigour index and accelerated aging germination. On the other hand, mean germination time increased from 2.5 days for untreated seed to 2.7 days for fumigated seed at 35°C + malathion and fumigated seed at 40°C + malathion. Readings of electrical conductivity recorded its lowest means 0.086 *µmhos/gm seed* for fumigated seed at 30°C. Meanwhile the highest read (0.090 *µmhos/gm seed*)was recorded from untreated seed or malathion and fumigated seed at 40°C + malathion. The harmful effect with increasing fumigation temperature might be due to deeper fumigant penetration in the structure of seed under higher temperature. So that, the higher fumigation temperature, the greater fixation rate and the longer disruption rate (Strong and Lindgren, 1960), (Caubel *et al.*, 1985) and (Sittisuange and Nakakita, 1985). With respect to the effect of chemical insecticides on insect infestation percentage and seed dry weight loss percentage, untreated seed had the highest means of insect infestation % and seed dry weight loss% (5.55% and 3.07%) respectively. On contrast, fumigated seed at 40°C + malathion had the lowest means (1.26% and 0.82%) respectively, of insect infestation and seed dry weight loss percentage. The efficacy of this treatments could be refer to the combined effect where insects weakened by fumigation were further killed when exposed to malathion

The data presented in Table (2) revealed that, high significant effect for the interaction between storage periods and seed moisture content on all studied traits. Germination percentage reached its highest mean 99.0% at 12% moisture level initially after treatment mean while it reduced to 51.0% after storage with 18 months at 18% moisture content. The same trend was noticed for the germination index, germination rate and accelerated aging on contrast mean germination time reached its earlier time 2.1 day at 12% moisture content at the first storage period and its lately time 3.2 day at seed moisture level 18% after 18 months from storage. Plumule length, radical length, seedlings dry weight and seedling vigour index produced their highest means at 12% moisture level with the first storage period meanwhile, these traits produced their lowest means after 18 months from storage at the high moisture level 18%. The reduction in seed viability and seedling traits might be due to the increase in respiration rates due to increasing seed moisture content during storage especially if it follows with an increase in temperature during storage which cause rapid consuming of some organic compounds by this process or increase in the activities of storage pests. Furthermore, with increasing storage period the damage caused by storage pests increased. These results are similar with those reported by (Bekheit *et al.*, 1983) and (Tipples, 1995). All moisture levels at the first storage period did not had any insect infestation or loss in seed dry weight. On the other side, insect infestation and seed dry weight loss reached 9.38% and 7.03% respectively, at 18% seed

moisture content after storage with 18 months. Also measurements of electrical conductivity increased from 0.069 *µmhos/gm seed* to 0.136 *µmhos/gm seed* with increasing moisture level from 12% to 18% and storage period from 0 to 18 months. Insect infestation increased with increasing seed moisture levels and storage periods, as indicated by the results of that seed dry weight losses.

Table (2): Effect of interaction between storage periods and seed moister content on wheat seed viability and seedlings vigour traits, insect infestation percentage and seed dry weight loss percentage.

Treatment		Germination%	Germ. Index	Germination rate	Mean germ. Time (day)	Plumule length(cm)	Radical length(cm)	Seedlings dry wt.(g)	Accerelated aging germ.%	Insect infestation %	Seed dry weight loss %	Seedlings vigour Index	Electrical conductivity *umhos/gm seed umhos/gm seed*
Storage periods/ months	Moisture content%												
0	12%	99.0	31.5	0.984	2.1	9.9	10.5	0.346	79.0	0.00	0.00	2006.1	0.069
	15%	98.0	30.0	0.966	2.2	9.9	10.4	0.347	78.0	0.00	0.00	1995.6	0.069
	18%	97.0	27.4	0.947	2.3	9.9	10.4	0.345	73.0	0.00	0.00	1958.4	0.071
6	12%	98.0	26.6	0.936	2.3	9.8	10.3	0.343	77.0	0.26	0.14	1980.1	0.073
	15%	96.0	25.1	0.918	2.4	9.8	10.3	0.342	74.0	0.44	0.20	1936.6	0.075
	18%	88.0	22.3	0.906	2.5	8.8	9.6	0.333	57.0	0.58	0.49	1628.6	0.080
12	12%	96.0	23.0	0.877	2.6	9.7	9.9	0.339	73.0	0.61	0.20	1885.0	0.084
	15%	95.0	21.5	0.866	2.7	9.6	9.4	0.332	69.0	0.62	0.31	1806.7	0.089
	18%	64.0	13.5	0.835	2.8	6.0	9.7	0.212	41.0	5.41	3.32	880.9	0.096
18	12%	95.0	15.4	0.810	3.0	9.4	9.6	0.325	67.0	1.90	0.56	1799.8	0.098
	15%	93.0	13.2	0.769	3.2	9.1	9.0	0.321	61.0	3.12	1.20	1685.8	0.116
	18%	51.0	7.1	0.751	3.2	5.2	5.3	0.302	30.0	9.38	7.03	539.4	0.136
LSD 0.05%		0.9	0.5	0.009	0.1	0.2	0.1	0.005	0.9	0.06	0.10	23.9	0.001

Data in Table (3) showed high significant effect for the interaction between storage periods and insecticides seed treatments. The highest mean values of germination percentage, germination index and germination rate (99.0%, 31.6 and 0.986) respectively, were obtained from untreated seed at the first storage period. Meanwhile the lowest means of these traits were recorded after 18 months from *fumigation* at 40°C + malathion. The same trends were noticed for plumule, radical length, seedlings dry weight, seedlings vigour index and accelerated aging germination. On the other hand, mean germination time was increased from 2.1 day at the first storage period for untreated or treatment seed with malathion to 3.4 day for fumigated seed at temperature degree 40°C + malathion, after 18 months from storage. At the first and second storage periods all insecticides treatments protect wheat seed from insect infestation and dry weight loss, meanwhile after 18 months from storage insect infestation and seed dry weight loss in untreated seed reached their maximum means 11.28% and 5.44%, respectively.

Table (3): Effect of interaction between storage periods and seed pesticides treatments on wheat seed viability and seedlings vigour traits, insect infestation percentage and seed dry weight loss percentage.

Treatment		Germination%	Germ. Index	Germination rate	Mean germ. Time (day)	Plumule length(cm)	Radical length(cm)	Seedlings dry wt(g)	Accumulated aging germination %	Insect infestation %	Seed dry weight loss %	Seedlings vigour index	Electrical conductivity (mmhos/gm seed)
Storage periods/month	Insecticides treatment												
0	Control	99.0	31.6	0.985	2.1	10.0	10.5	0.346	78.0	0.00	0.00	2033.8	0.069
	Malathion	99.0	31.3	0.984	2.1	9.9	10.5	0.346	78.0	0.00	0.00	2023.8	0.068
	Fumig.at 30C	99.0	30.9	0.977	2.3	9.9	10.5	0.346	77.0	0.00	0.00	2018.6	0.069
	Fumig.at 35C	98.0	29.7	0.966	2.2	9.9	10.4	0.346	77.0	0.00	0.00	1998.6	0.071
	Fumig.at 40C	97.0	29.0	0.965	2.2	9.9	10.3	0.347	76.0	0.00	0.00	1948.9	0.071
	Fumig.at 30C+Malathion	99.0	29.1	0.956	2.2	9.8	10.4	0.346	77.0	0.00	0.00	1993.1	0.071
	Fumig.at 35C+Malathion	96.0	28.1	0.951	2.3	9.9	10.4	0.346	75.0	0.00	0.00	1953.4	0.070
	Fumig.at 40C+Malathion	95.0	27.2	0.941	2.3	9.9	10.3	0.345	75.0	0.00	0.00	1920.6	0.072
6	Control	95.0	24.7	0.918	2.4	9.6	10.0	0.338	70.0	3.43	2.20	1862.2	0.078
	Malathion	96.0	25.2	0.927	2.4	9.7	10.3	0.342	71.0	0.00	0.00	1912.8	0.075
	Fumig.at 30C	96.0	26.9	0.941	2.3	9.6	10.3	0.343	70.0	0.00	0.00	1896.8	0.074
	Fumig.at 35C	95.0	25.4	0.934	2.3	9.4	10.1	0.339	70.0	0.00	0.00	18426	0.075
	Fumig.at 40C	94.0	23.4	0.909	2.5	9.3	10.0	0.338	69.0	0.00	0.00	18128	0.076
	Fumig.at 30C+Malathion	96.0	25.6	0.924	2.4	9.6	10.0	0.340	70.0	0.00	0.00	1875.2	0.074
	Fumig.at 35C+Malathion	93.0	24.2	0.913	2.4	9.4	10.0	0.337	68.0	0.00	0.00	1814.6	0.076
	Fumig.at 40C+Malathion	92.0	21.8	0.894	2.5	9.3	9.9	0.338	67.0	0.00	0.00	1770.5	0.078
12	Control	87.0	20.8	0.886	2.6	8.5	8.8	0.286	62.0	7.50	4.54	1534.1	0.091
	Malathion	89.0	21.6	0.876	2.6	8.6	9.2	0.297	65.0	1.72	0.91	1614.6	0.089
	Fumig.at 30C	87.0	22.8	0.885	2.6	8.5	9.2	0.297	62.0	1.37	0.81	1583.1	0.087
	Fumig.at 35C	86.0	20.0	0.847	2.8	8.6	9.0	0.296	61.0	1.37	0.79	1544.6	0.090
	Fumig.at 40C	84.0	18.1	0.852	2.7	8.4	8.9	0.296	60.0	1.64	0.78	1500.0	0.091
	Fumig.at 30C+Malathion	86.0	18.2	0.854	2.7	8.5	9.1	0.296	62.0	1.37	0.76	1541.5	0.086
	Fumig.at 35C+Malathion	83.0	17.7	0.834	2.8	8.3	8.8	0.295	58.0	1.37	0.79	1460.9	0.089
	Fumig.at 40C+Malathion	80.0	15.6	0.839	2.8	8.2	8.8	0.293	58.0	1.36	0.77	1414.8	0.092
18	Control	81.0	12.0	0.776	3.1	7.5	7.8	0.271	53.0	11.28	5.44	1329.0	0.120
	Malathion	82.0	15.3	0.821	2.9	7.9	8.0	0.286	54.0	4.39	2.71	1387.2	0.114
	Fumig.at 30C	82.0	15.7	0.831	2.9	8.1	8.2	0.287	54.0	3.85	2.58	1406.4	0.115
	Fumig.at 35C	81.0	12.9	0.795	3.1	8.1	8.2	0.286	53.0	3.82	2.56	1384.1	0.115
	Fumig.at 40C	79.0	10.2	0.748	3.3	7.9	8.1	0.286	52.0	3.80	2.53	1341.4	0.116
	Fumig.at 30C+Malathion	81.0	11.0	0.756	3.2	8.1	8.0	0.285	53.0	3.81	2.57	1366.3	0.116
	Fumig.at 35C+Malathion	78.0	9.4	0.757	3.3	7.7	7.8	0.283	52.0	3.73	2.54	1376.3	0.118
	Fumig.at 40C+Malathion	76.0	8.5	0.730	3.4	7.6	7.6	0.283	50.0	3.69	2.52	1242.7	0.120
LSD 0.05%		1.2	0.7	0.011	0.1	0.2	0.2	0.007	1.3	0.08	0.15	32.3	0.001

The data concerned the effect of the interaction between seed moisture content and insecticides treatments are recorded in Table (4), high significant effects were noticed on all the studied traits. At the lowest moisture level (12%), germination percentage, seed quality and seedlings vigour traits had the highest mean values without significant differences between both of control, malathion or fumigation at 30°C. On contrast, the lowest mean Values of these traits were recorded at moisture content 18% at fumigation at 40°C + malathion. Also mean germination time, electrical conductivity, insect infestation and seed dry weight loss were increased gradually with increasing seed moisture content from 12% to 18% especially with untreated samples or fumigated at 40°C + malathion. The reduction in seed viability and seedlings vigour might be due to the deeper penetrate of the fumigant by increasing seed moisture content in grains and temperature degrees during fumigation and the longer rate of the toxic effect by the fumigant. Similar results were reported by (Sittisuange and Nakakita, 1985).

Table (5) shows the correlation coefficient between correlation germination percentage, germination index mean germination time, germination rate, seedlings vigour traits, accelerated aging germination, insect infestation percentage and seed dry weight loss percentage with both of storage periods and seed moisture content. There were negatively and highly significantly correlation for the relationship between germination percentage (r=-0.476), germination index (r=-0.865), germination rate (r=-0.898), plumule length (r=-0.510), radical length (r=-0.644), seedlings dry weight (r=-0.526), accelerated aging germination (r=-0.601), seedlings vigour index (r=-0.553) and storage periods. On contrast, there were positively and highly correlation for mean germination time (r=0.885), insect infestation percentage (r=0.556) and seed dry weight loss percentage (r=0.491). There were also highly negatively correlation for germination percentage (r=-0.602), germination index (r=-0.355), germination rate (r=-0.219), plumule length (r=-0.580), radical length (r=-0.512), seedlings dry weight (r=-0.532), accelerated aging germination (r=-0.651), seedlings vigour index (r=-0.595) with seed moisture content. On the other side, there were positively correlations for mean germination time (r=0.219), insect infestation percentage (r=0.395) and seed dry weight loss percentage (r=0.455) with seed moisture contents. Table (6), shows that, there were negatively and highly significant correlations between insect infestation and all the studied traits except mean germination time, seed dry weight loss and electrical conductivity while positively and significant correlations were noticed (r=0.591, 0.961 and 0.765), respectively. The results suggested treating wheat seed with malathion 57%, fumigation with phosphine at 35°C, fumigation at 30°C + malathion without harmful effects on wheat (c.v. Gemmiza 7) seed quality or seedlings vigour provided that the seed moisture content should be ranged between (12-15%).

Table (4): Effect of interaction between seed moisture content and seed chemical treatments on wheat seed viability and seedlings vigour traits, insect infestation percentage and seed dry weight loss percentage.

Treatment		Germination%	Germ. Index	Germination rate	Mean germ. Time(day)	Plumule length(cm)	Radical length(cm)	Seedlings dry wt.(g)	Accumulated aging germination %	Insect infestation %	Seed dry weight loss %	Seedlings vigour index	Electrical conductivity (mmhos/cm seed)
Moisture content	Insecticides treatment												
12%	Control	98.0	24.9	0.916	3.4	9.6	10.1	0.336	75.0	3.28	1.24	1938.1	0.081
	Malathion	99.0	25.7	0.919	3.4	9.8	10.1	0.336	75.0	0.44	0.12	1965.1	0.080
	Fumig.at 30C	98.0	26.8	0.931	3.3	9.8	10.2	0.339	75.0	0.32	0.08	1961.8	0.079
	Fumig.at 35C	97.0	24.8	0.897	3.5	9.7	10.1	0.339	74.0	0.32	0.08	1926.5	0.081
	Fumig.at 40C	97.0	22.9	0.883	3.6	9.7	10.0	0.339	73.0	0.32	0.07	1902.8	0.082
	Fumig.at 30C+Malathion	97.0	23.8	0.889	3.5	9.8	10.1	0.339	74.0	0.31	0.08	1925.3	0.080
	Fumig.at 35C+Malathion	96.0	22.7	0.880	3.5	9.5	10.0	0.338	73.0	0.28	0.07	1865.8	0.082
	Fumig.at 40C+Malathion	94.0	21.5	0.87	3.5	9.7	10.0	0.337	72.0	0.27	0.07	1856.4	0.083
15%	Control	96.0	23.9	0.885	3.6	9.6	9.6	0.335	72.0	4.79	2.02	1870.6	0.089
	Malathion	98.0	24.7	0.904	3.5	9.6	9.9	0.337	72.0	0.53	0.22	1910.4	0.086
	Fumig.at 30C	97.0	25.8	0.909	3.5	9.7	9.9	0.336	71.0	0.53	0.20	1908.2	0.085
	Fumig.at 35C	97.0	22.9	0.885	3.6	9.7	9.8	0.337	71.0	0.51	0.20	1861.9	0.088
	Fumig.at 40C	95.0	21.1	0.875	3.6	9.5	9.7	0.337	70.0	0.50	0.20	1830.2	0.087
	Fumig.at 30C+Malathion	97.0	21.7	0.865	3.7	9.6	9.7	0.336	72.0	0.51	0.19	1870.3	0.086
	Fumig.at 35C+Malathion	94.0	20.7	0.857	3.7	9.7	9.7	0.336	69.0	0.50	0.20	1813.3	0.088
	Fumig.at 40C+Malathion	92.0	18.1	0.848	3.8	9.5	9.6	0.336	68.0	0.50	0.20	1762.1	0.090
18%	Control	75.0	17.7	0.873	2.9	7.4	8.2	0.270	54.0	8.58	5.95	1260.6	0.099
	Malathion	78.0	19.5	0.860	2.9	7.6	8.5	0.277	54.0	3.61	2.38	1329.3	0.094
	Fumig.at 30C	77.0	19.0	0.875	2.9	7.7	8.5	0.275	54.0	3.08	2.26	1308.3	0.095
	Fumig.at 35C	75.0	18.3	0.893	2.9	7.6	8.4	0.274	50.0	3.06	2.24	1268.1	0.095
	Fumig.at 40C	74.0	18.6	0.847	2.9	7.6	8.2	0.273	49.0	3.26	2.21	1219.4	0.097
	Fumig.at 30C+Malathion	77.0	17.4	0.854	2.7	7.6	8.3	0.275	51.0	3.06	2.22	1286.3	0.094
	Fumig.at 35C+Malathion	73.0	16.2	0.845	2.8	7.3	8.1	0.272	49.0	3.05	2.23	1199.8	0.095
	Fumig.at 40C+Malathion	71.0	14.8	0.826	2.9	7.2	7.9	0.270	48.0	3.03	2.20	1142.9	0.098
LSD 0.05%		1.1	0.6	0.010	0.1	1.9	1.6	0.006	1.1	0.01	0.01	28.9	0.001

Table (5): Correlation coefficient of storage periods and seed moisture content with the studied traits.

Character	Storage periods/months	Seed moisture content
Germination percentage	-0.476**	-0.602**
Germination index	0.865**	-0.355**
Mean germination time	0.885**	0.219**
Germination rate	-0.898**	-0.219**
Plumule length	-0.510**	-0.580**
Radical length	-0.644**	-0.512**
Seedlings dry weight	-0.526**	-0.532**
Seedlings vigour index	-0.553**	-0.595**
Accelerated aging test	-0.601**	-0.651**
Electrical conductivity	0.863**	0.301**
Insect infestation	0.556**	0.395**
Seed dry weight loss	0.491**	0.455**

Table (6): Correlation coefficient of insect infestation with the studied traits.

Characters	11	10	9	8	7	6	5	4	3	2	1	y
y-Insect infestation	-0.801**	0.765**	0.961**	-0.772**	-0.815**	-0.832**	-0.801**	-0.603**	0.591**	-0.692**	-0.776**	1.000
1-Germination percentage	0.990**	-0.723**	-0.841**	0.964**	0.955**	0.938**	0.973**	0.608**	-0.599**	0.757**	1.000	
2-Germination index	0.807**	-0.915**	-0.668**	0.845**	0.751**	0.839**	0.761**	0.949**	-0.930**	1.000		
3-Mean germ. time	-0.660**	0.892**	0.560**	-0.705**	-0.605**	-0.734**	-0.609**	-0.975**	1.000			
4-Germination rate	0.670**	-0.902**	-0.559**	0.714**	0.614**	0.743**	0.619**	1.000				
5-Plumule length	0.986**	-0.732**	-0.840**	0.948**	0.961**	0.929**	1.000					
6-Radical length	0.960**	-0.871**	-0.877**	0.933**	0.913**	1.000						
7-Seedlings dry wt.	0.962**	-0.772**	-0.842**	0.914**	1.000							
8- Accelerated aging	0.972**	-0.801**	-0.810**	1.000								
9- Seed dry weight loss %	-0.849**	0.747**	1.000									
10-Electrical conductivity	-0.775**	1.000										
11- Seedlings vigour index	1.000											

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تأثير مدة التخزين ومحتوي رطوبة البذرة والمعاملة بالمبيدات الحشرية على صفات جودة تقاوي القمح.

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تهدف هذة الدراسة إلى تحديد تأثير بعض العوامل مثل مدة التخزين ومحتوى رطوبة البذرة ومعاملة البذور بالمبيدات الحشرية على حيويتها وقوة إنباتها وإصابتها بالحشرات. لذا أجريت تجربة معملية اشتملت تخزين تقاوي القمح من الصنف جميزة ٧ لمدد (صفر، ٦، ١٢ و١٨ شهر) بعد تعديل نسبة الرطوبة بالبذور إلى ثلاث مستويات (١٢، ١٥، ١٨ %) على أساس الوزن الجاف وكذلك معاملة البذور قبل تخزينها (بالملاثيون ٥٧ %، التبخير بالفوسفين عند درجة حرارة ٣٠ م°، ٣٥ م°، ٤٠ م° والتبخير بالفوسفين عند درجة حرارة ٣٠ م°، ٣٥ م°، ٤٠ م° + الملاثيون). أوضحت النتائج:- أن زيادة فترة التخزين ومحتوى رطوبة البذرة أدي إلى تناقص الحيوية (كما تم قياسها بالنسبة المئوية للإنبات ودليل الإنبات ومعدل الإنبات) وقوة البادرات (طول الريشة والجذير والوزن الجاف للبادرة ودليل قوة الإنبات) واختبار الشيخوخة. بينما أدى زيادة فترة التخزين ومحتوى رطوبة البذرة إلى زيادة متوسط زمن الإنبات ودرجة التوصيل الكهربي للبذور والإصابة الحشرية والفقد في الوزن الجاف للبذور. معاملة بذور القمح بالملاثيون ٥٧% والتبخير في درجات حرارة ٣٠،٣٥م° والتبخير فى ٣٠م° + الملاثيون لم يكن لهم تأثير ضار على إنبات البذرة وقوة البادرة.وعلي العكس من ذلك فلقد أدى التبخير في ٤٠م° و٣٥ م° + الملاثيون والتبخير فى ٤٠م° + الملاثيون إلى انخفاض إنبات البذرة وقوة البادرة. أدت المعاملة بالمبيدات الحشرية إلى حماية القمح تحت ظروف التجربة من الإصابة الحشرية لمدة تزيد عن ٦ شهور وكان مستوى الإصابة الحشرية أقل لمدة ١٢ شهر مقارنة بالبذور الغير معاملة. كما وجد علاقة سالبة وذات تأثير معنوي لفترات التخزين ومحتوى الرطوبة بالبذرة والإصابة الحشرية مع كل الصفات المدروسة، فيما عدا متوسط زمن الإنبات ودرجة التوصيل الكهربي للبذور والفقد فى الوزن الجاف للبذور،حيث وجد إرتباط موجب ذوتأثير معنوي. وتقترح الدراسة تخزين تقاوي القمح بعد ضبط رطوبة البذور لتكون بين (١٢-١٥%) ومعاملتها ب (الملاثيون ٥٧% أوالتبخير في درجات حرارة ٣٠ و٣٥م° أوالتبخير فى ٣٠ م° + الملاثيون) قبل التخزين وذلك للمحافظة على حيوية التقاوي وصلاحيتها للزراعة.