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Effect of package materials on associated fungi and chemical composition of sorghum seeds during storage

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ABSTRACT

Three types of packaging materials i.e., high density polyethylene (143 g/m2-HDP), 0.1-mm thick Kraft paper bags and woven polyethylene (WP) were used in combination with different temperature storage (ambient temperature 25±3 °C, 10-12°C and 5-6°C in refrigerator) during 2 storage periods of 6 and 12 months. The interaction effect of different temperature and storage package types showed significant differences in associated seed borne fungi and chemical composition of the stored seed compared with the seeds in the control treatment stored at ambient temperature determined at zero time of storage. Associated fungi detected with sorghum seed by seed health test methods were *Fusarium verticillioides, F. semitectum, F. oxysporium, Curvularia lunata, Aspergillus niger, A. flavus, Penicillium sp, Alternaria solani, A. alternata, Bipolaris sorghicola, Drechslera oryzae and Epicoccum nigrum.* Results indicated that the highest frequency of seed borne fungi associated with sorghum seed was recorded for samples stored in high density polyethylene (HDP) package under room temperature condition after 6 months followed by samples stored in Kraft paper package, the total seed borne count numbers were 129 and 109.33, respectively, while, storage in woven polyethylene (WP) package had the lowest total count (78.67) of seed borne fungi. As regard to sorghum seeds chemical component, data of storage experiments showed that storage at room temperature generally resulted in reduction of crude fiber, ash, oil, crude protein, germination percentage and oil quality while it showed increase of free fatty acid and acidic value especially in seed stored in HDP package. The weight of 100 kernels were also decreased and total infection count were increased under storage at room temperature specially with using HDP package type compared with control treatment (at zero time storage). Storage at ambient room temperature for six and twelve months periods, generally resulted in decreasing of crude protein%, crude fiber%, ash%, oil%, oil quality[by increasing of free fatty acid% (FFA) and acidic value (AV)] and weight of 100 kernels, especially, under high density polyethylene (HDP)package kind ,while , total infection of sorghum seeds by rots causal organisms increased. On the other hand, storage at low temperature (10-12centegrat) with using woven polyethylene (W.p) packages kind led to few decreasing in sorghum seeds chemical component percentages as well as few decreasing of weight of 100 kernels ,the increasing in total infection percent of sorghum seeds by seed rots causal organisms were also low comparing with control treatment (after zero time storage) under two tested storage periods .Moreover, the lowest sorghum seed rots disease percentages, the lowest decrease in tested seeds chemical component , the lowest decrease in weight of 100 kernels , the highest increase in oil quality and the highest increase in germination percentages were obtained with storage in woven polyethylene packages kind under 5-6 centigrade in both tested storage periods . The reverse was true with storage in other tested packages kind, especially with storage in high density polyethylene (HDP) packages kind. In brief In summarized, the storage of sorghum seeds in woven polyethylene packages kind type under low temperature (5-6

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°~~centigrade~~C) was very suitable and led to ~~avoid~~ reduction ~~the high severity of infection by seed rots causal organisms~~of storage fungi and ~~avoid also decreasing~~ ~~in~~to keep seed ~~s~~ chemical components and ~~decreasing of~~ oil quality ~~in~~ of the seeds. Therefore, the need to maintain the temperature, relative humidity and type of storage package is important criteria of storage.

Key-words: Sorghum seeds, package materials, Storage, seed borne fungi.

INTRODUCTION

Grain mold is the most important and widespread deterioration of grain sorghum (*Sorghum bicolor* L. Moench.) worldwide. It considered as a major constraint during seed production and storage. Damage due to grain mold has been associated with loses in seed mass, grain density, seed germination, storage quality, food and feed processing quality and market value. Moreover, some of the mold fungi are producers of potent mycotoxin that are harmful to human and animal health and productivity. Production losses due to sorghum grain mold range from 30% to 100% depending on cultivar, time of flowering and prevailing weather conditions during flowering (Singh and Bandyopadhyay, 2000). ~~Careful storage may help in alleviating problems of seed viability and large seed crops may be used for several years of revegetation activity, avoiding the need to rely on the current crop alone. Seed of most species may be safety stored for several years by careful control of temperature and relative humidity.~~ Bass and Stanwood (1977) and Roberts (1981) suggested that ~~, the~~ general principle is that low moisture and high quality seeds stored under cool and dry conditions maintain seed quality better than high moisture and low quality seeds under ~~humid~~ storage conditions. ~~Anonymous (1991) reported that,~~ Careful storage may help in alleviating problems of seed viability and large seed crops may be used for several years of re-vegetation activity, avoiding the need to rely on the current crop alone. Seed of most species may be safety stored for several years by careful control of temperature and relative humidity. ~~proper storage minimizes the rate of deterioration and prolongs the first phase, in which relatively little loss of viability occurs. Seed deterioration increased and life span decreased as storage temperature and moisture content increased. Moreover,~~ El-Aidy *et al*. (2001) reported that the germination percentages of cotton seeds affected by interaction of storage periods and packing materials. ~~,~~ Significant differences were observed for packing materials. Storage in woven polyethylene package recorded the highest germination values for cotton seeds. Owolade *et al*.(2011) reported that sorghum seeds stored at three different storage temperature (gene bank temperature -5°C), freezing temperature (-20 ± 2°C) and ambient temperature (25 ± 3°C), while the packaging materials were in an aluminum can, plastic container and polyethylene bag. The result showed that sorghum seeds stored inside gene bank and freezer irrespective of the packaging materials and type of accession retain their viability to the tune of 90.67 to 100%. Whereas; seeds stored at ambient temperature had low germination percentage (10.67 to 28.00%) except those stored in aluminum can (41.33%).

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~~it was highly significantly different. Moreover, cotton seeds which stored in woven polyethylene packages recorded the highest germination values.~~ Forbes *et al*. (1992), Shetty *et al*. (1995), Farahat (2001), and Bandyobadhyay *et al* (2002) found that~~,~~ sorghum grains should be dried to 10-12% moisture after harvest~~ing~~ using ~~grain~~ drying technology or sun-drying to avoid molding during storage and further processing. ~~Propionic acid has been used as a mold inhibitor during the drying process to reduce the risk of mould development.~~ Tolba and EL-Sayed~~-~~, Soad (2002) added that percentage of fungal infection of maize grains were positively correlated with grains content of free fatty acid (F.F.A), acidic value (A.V), acidity and crude protein of grains ~~percentages~~during storage. In the reverse, the percentage of fungal infection was negatively correlated with maize grain~~s~~ content~~s~~ of endosperm ~~percentage~~. ~~While~~On the other hand, El-Sayed *et al*. (2004) reported that, the lowest values of free fatty acid (F.F.A.), acidic value (A.V.) ~~and~~ acidity percentages and the highest germination were ~~obtained~~ determined ~~from~~ in seed stored inside high density polyethylene packages. ~~On the other hand~~Moreover, EL-Sayed, Soad and Tolba (2005), Shobha *et al*. (2008) reported that, the storage at 10°C condition~~s~~ gave the highest values for germination ~~%~~ and ~~the~~ best oil characters ~~(~~by decreasing free fatty acid percentage and acidic value~~)~~. ~~However, harvesting at physiological maturity when moisture levels are below 18/% reduces grain mould damage.~~

This work aims to study the effect of storage package types and storage conditions on the associated seed borne fungi and chemical ~~constitute~~ content changes during 6 and 12 months of storage.

MATERIALS AND METHODS

The present investigation was carried out in ~~the Laboratory of~~ Seed Technology Laboratory and ~~the Laboratory of~~ Plant Pathology Laboratory at ~~Sakha~~ Agricultural Research Station at Sakha, Egypt ~~, ARC,~~ during 2012 and 2013 seasons. One commercial susceptible hybrid (sorghum hybrid 888) was used. A weight of 15 kg from seeds were taken at random and packaged in ~~containers~~ bags made from different materials i.e., ~~[~~high density polyethylene (143 g/m^2~~- (~~HDP), 0.1-mm thick Kraft paper bags ~~paper package (PP)~~ and woven polyethylene (WP).~~],~~ ~~E~~each package was filled with 1/2 kg of tested hybrid seeds in three replicates and stored at ~~three~~ different periods ~~(i.e.~~ of 6, 12 months and control at zero time.~~after zero time, after six months and after twelve months) and under three~~Packages were stored at different conditions ~~(i.e. storage at~~at room temperature 25 ± 3 °C, ~~storage at~~ 10-12°C and ~~storage~~ at 5-6°C of storage inside refrigerator). ~~These~~ All samples were ~~subjected~~ tested ~~for~~to germination, physical and chemical composition. Seed health test on agar plates according to ISTA rules (1985) were done for detection of associated fungi and to determine the effect of different storage conditions on seed fungal infection load. ~~and were also subjected to seed rots fungi isolation (i.e. *Fusarium verticillioides, Fusarium semitectum , Fusarium oxysporium, Curvularia lunata, Aspergillus niger, Aspergillus flavus, Penicillium sp., Alternaria solani, Alternaria alternata, Epicocum nigrum, Helminthosporium sorghicola* and *Nigrospora, Fusarium*~~

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~~oryzae).~~ The collected data were analyzed according to the factorial completely randomized design with three replicates.

Standard germination test was carried out under optimum conditions according to the international rules of testing (ISTA, 1999).

~~Some c~~Chemical composition analysis:

As for chemical composition characters, seed samples were taken at random from each sorghum seeds package and gr~~ou~~inded to fine powder to pass through 2 mm mesh. ~~for c~~The following~~hemical~~ analysis were determined according to procedures outlined in AOAC (1990) ~~i.e.~~ for ~~moisture content~~, oil, crude protein ~~%~~, crude fiber ~~%~~, ash ~~%~~, free fatty acids (FFA)~~%~~ contents, acid value (AV) ~~and acidity~~ acidity and seed moisture (ISTA rules, 1999) ~~% were determined according to procedures outlined in AOAC (1990). as follows:~~

~~a.~~ **Moisture content**:

Samples of 5 g of sorghum seeds were taken randomly and weighed to three decimal places. The grains were grinded before drying using a grinding mill so that at least 50% of the ground material passed through a wire sieve with meshes of 0.50 mm and not more than 10% was remained on the wire sieve with meshes of 1 mm.

a. High constant temperature oven method was utilized. The working sample was evenly distributed over the surface of the drying container which was weighed with its cover before and after filling. The container was placed on top of its cover in an oven maintained at a temperature of 130±3^{o}C for two hours. At the end of prescribed period the container was covered and placed in desiccators to cool for 30 minutes.

The moisture content as a percentage by weight (fresh weight basis) is calculated to one decimal place, by using of the formulae:

% seed moisture content (mc) = M2-M3 / M2-M1 x 100

Where:

M1 = Weight of the weighing bottle/container with cover in gm

M2 = Weight of the weighing bottle/container with cover and seeds before drying

M3 = Weight of the weighing bottle/container with cover and seeds after drying. ~~The moisture content was expressed as a percentage by weight to one decimal place by means of the following formula:~~

$$\text{Moisture content} = M_2 - M_3 \times \frac{100}{M_2 - M_1}$$

~~Where:~~

~~M1= The weight in grams of the container and its cover.~~

~~M2= The weight in grams of the container and its cover and its contents before drying~~

~~M3= The weight in grams of the container and its cover and its contents after drying.~~

The mean of four replicates was considered reliable if the difference between replicates didn't exceed 0.2% other wise, the test was repeated (ISTA, 1999).

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~~b. Grain p~~Protein content:

b. The micro-Kjeldahl method was used to determine the total nitrogen in grain and multiple by 1.63 to obtain the content of crude protein according to AOAC (1990).

~~C. Grain o~~Oil, free fatty acid (FVA), ash and crude fiber (%):

c. Oil and other components content of grain was determined as the method described by the AOAC (1990) using Soxhlet apparatus and petroleum ether (40-60oC) as a solvent.

~~d.~~ Acidity:

d. Samples of 15 g~~m~~ of sorghum seeds were taken randomly and grinded before drying using a grinding mill. Acidity percent was determined as described by the AOAC method (1990).

e. **Weight of 100 kernels**: One hundred seeds from each package under each storage period and condition were taken and weighed

All the aforementioned measurements were estimated before storage (at zero time) and after the tested storage periods (six and twelve months) under all tested storage conditions.

~~E. Isolation~~Seed health test:

~~Sorghum seed rots fungi isolations~~Associated fungi with seed represent different samples in storage experiment were carried out ~~under~~ in laboratory ~~tests~~ using PDA ~~pmedia~~ lates according to seed health testing rules ~~ISTA~~of ISTA (1985). Frequency of each i~~I~~solated fungi were recorded and each isolated fungus was identified in department of Mycology, Institute of Plant Pathology, ARC, Giza, Egypt.

~~**F. Weight of 100 kernels:**~~

~~**One hundred seeds from each package under each storage period and condition were taken and weighed**~~

~~**All the aforementioned measurements were estimated before storage (at zero time) and after the tested storage periods (six and twelve months) under all tested storage conditions.**~~

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RESULTS AND DISCUSSION

Associated fungi detected with sorghum seed by seed health test methods were *Fusarium verticillioides, F. semitectum, F. oxysporium, Curvularia lunata, Aspergillus niger , A. flavus, Penicillium sp, Alternaria solani, A. alternata, Bipolaris sorghicola, Drechslera oryzae and Epicoccum nigrum.* As regard to after six months storage period, dData presented in Table 1 and Fig. 1 showed that, the highest frequency of causal organisms of seed borne fungi associated with sorghum seed rots was recorded for samples stored in high density polyethylene (HDP) package under room temperature conditions after 6 months specially under high density polyethylene (HDP) package kind, followed by samples stored under in Kraft paper package kind, the total infection seed borne counted numbers were 129 and 109.33, respectively, while, storage at in Wwoven polyethylene (WP) package kind had the lowest total count (78.67) infection of seed borne fungicounted number i.e. 78.67. On the other hand, data presented in Table 1and Fig. 1 for seed samples stored and under 10-12^{o}C storage conditiontemperature, data presented in Table 1and Fig. 1 clarified that , total infection percent was generally decreased specially with in wWoven polyethylene (WP) package on which ; it was total infection recorded was total infection 62.00. In the reverse, seed samples stored in storage using HDP package was led to high count of total infection (109.00) compareding with control treatment of seed borne fungi determined (at zero time of storage) , it that recorded 67.67 total fungal infections. Moreover, storage at 5-6^{o}C condition had generally the lowest count of infection especially with using in seed samples stored in Wwoven polyethylene package kind (51.33), and Kraft paper package kind (65.67). W while, the total count of total infectionseed borne fungi was very high (126.33) under in seed stored in HDP package kind and recorded 126.33 comparingcompared with control treatment. (at zero time) which recorded 67.67 of total infection. These results were in the same line with that obtained by Anonymous (1991), El-Aidy *et al.* (2001) and Frahat (2001), they who found that seed deterioration increased and life span decreased as storage temperature and moisture content increased. The germination percentage was highly significant decreased after six months of storage period. They added that, cotton seeds which stored in wWoven polyethylene packages at low temperature (7-10^{o}C) recorded the highest germination values and lowest infection percent by seed rots diseaseborne fungi.

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~~As regard to~~ Data presented in table 1 and Fig. 2 after ~~twelve~~ 12 months of storage period~~, data presented in table 1 and Fig. 2~~ showed that ~~,~~ the total ~~infection~~ count of seed borne fungi was high under room temperature ~~with~~ in three tested package ~~kinds~~ types ~~i.e.~~of HDP, PP and WP ~~that~~ and it recorded 154.67, 121.33 and 94.00 ~~total infection~~, respectively~~,~~ followed by seeds stored under 10-12°C ~~using~~ in the three ~~kinds~~ types of tested packages ~~((HDP, PP and WP). The total infection count were~~ 128.00, 89.67 and 69.00), respectively, compared ~~ing~~ with seed sample of control treatment (67.67) inspected ~~(~~at zero time of storage ~~period) which was recorded 67.67 , of total infection.~~ On the other hand, the lowest value of total infection count were obtained under 5-6°C storage condition in woven polyethylene package ~~kind~~, it was 57.33. In the reverse, the highest value of total infection count (137.00%) was recorded after ~~twelve~~ 12 months for seed samples stored under condition of ~~under~~ 5-6°C ~~storage condition~~ in ~~and high density polyethylene (~~HDP~~)~~ package ~~kind~~. This result was in agreement with those of Owolade et al,(2011) who reported the presence of *Alternaria, Helminthosporium, Fusarium, Curvularia, Stemphylium, Rhizopus, Cladosporium, Aspergillus* and *Penicillium* species in sorghum seeds. ~~These results were similar with those obtained by~~Also, ~~Anonymous (1991), who found that, seed deterioration increased and life span decreased as storage temperature and moisture content increased, and the reverse was true.~~ Frahat (2001) ~~added~~ indicated that~~,~~ the lowest sorghum seeds infection percent by seed rots causal organisms were obtained ~~with~~ in storage at low temperature (7°C)~~, here, the highest germination percentage was also obtained~~.

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As regard to sorghum seeds chemical component, data presented in Tables 2 and Figs 1& 2 showed that~~,~~ storage at room temperature generally resulted in ~~decreasing~~ reduction of crude fiber, ash, oil, crude protein, germination percentage and oil quality while it showed increase ~~(increasing~~ of free fatty acid ~~%~~ and acidic value~~)~~, especially in ~~,~~ seed stored ~~with~~ in ~~high density polyethylene (~~HDP~~)~~ package ~~kind~~.

The weight of 100 kernels were also decreased and total infection count were increased under storage at room temperature specially with using HDP package kind ~~, as~~ compared~~ing~~ with control treatment (at zero time storage). On the other hand, data presented in ~~t~~Table 2 also showed that storage at 10°C led to ~~decreasing~~ reduction of certain ~~the~~ chemical component of stored seeds which mentioned above especially ~~i~~with ~~n~~ seed samples ~~using~~ stored in HDP ~~high density polyethylene~~ and Kraft paper packages ~~kind,~~ while, seed samples stored ~~age~~in ~~with using~~ woven polyethylene package led to ~~few~~ less ~~decreasing~~ reduction in recorded values of seed chemical component~~s~~ ~~and~~ that considered ~~recorded value~~ near or equal to values of the control treatment (at zero time storage). Moreover, seed storage at 5-6°C condition had the lowest ~~differ~~ effect in chemical component of seeds especially ~~with~~ in seed stored in ~~using~~ woven polyethylene package ~~kind~~, since the seed chemical component had values equal the control treatment with few non-significant ~~exceptions~~differences. In the reverse, seed stor~~ag~~ed ~~with~~in ~~high density polyethylene (~~HDP~~)~~ package under all tested storage conditions and storage periods ~~were~~ led to ~~decrease~~ reduction of crude fiber %, ash %, oil %, crude protein %, germination %, and oil quality

while ~~(by increasing of~~ free fatty acid% and acidic value were increased~~)~~, as well as, ~~decreasing~~ the weight of 100 kernels. The reverse was ~~true,~~true; when ~~using~~ seed samples were stored~~age~~ in woven polyethylene package ~~at~~ under all tested storage conditions and at all tested storage periods ~~, such as demonstrated~~ presented in Tables 2 and Figs. 1 & 2. The ~~decreasing~~ reduction of seeds chemical component and weight of 100 kernel during storage, especially, ~~at long~~after 12 months ~~storage period and under using~~for seed samples stored in ~~high density polyethylene~~HDP package may be led to stimulate seed respiration and resulting in a net loss in dry weight of the seed and a loss in viability as manifested by poor germination, ~~which recorded by~~as recorded and reported by Tolba and EL-Sayed, Soad (2002).

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Also, the finding of the study revealed that seeds of sorghum can best be stored under controlled environment for multiplication. Increase in moisture content over a period of time during storage coupled with high infection rates could lead to a substantial loss of sorghum seeds. These results were in the same line with recorded by El-Aidy *et al.* (2001) and EL-Sayed ,Soad and Tolba (2005), They found that, the germination percentages affected by interaction of storage periods and package materials, the seeds which stored in woven polyethylene packages recorded the highest germination values and lowest decrease in seeds compounds (i.e. crude protein, crude fiber, ash and oil quality [it's decrease by increase free fatty acid (FFA) and acidity value (AV)], as well as increasing weight of 100 kernels. They added that, percentage of fungal infection of maize grains were positively correlated with grains content of free fatty acid (FFA), acidic value (AV) and acidity. In the reverse, the percentage of fungal infection was negatively correlated with maize grains contents of crude fiber, endosperm, ash and oil. Therefore, the need to maintain the temperature, relative humidity and type of storage package is important criteria of storage.

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تأثير عبوات التخزين المختلفة على الفطريات المصاحبة لحبوب السورجم وكذلك التركيب الكيماوى لها

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**معهد بحوث أمراض النباتات ، قسم بحوث أمراض الذره والمحاصيل السكرية والأعلاف النجيلية ألصيفيه.

تم استخدام ثلاث أنواع من عبوات التخزين وهى البلاستيك السميك والورق والبلاستيك المنسوج تحت درجات حرارة تخزين مختلفة وهى درجة الحرارة المحيطة أو الغرفة (٣ + ٢٥ مْ) ودرجة حرارة تبريد (١٠-١٢ مْ) ودرجة حرارة تبريد (٥-٦ مْ) وذلك خلال فترات تخزين ٦شهور و١٢ شهر ووجد أن التفاعل بين درجات الحرارة المختلفة ونوع العبوات المختلفة أثناء التخزين أدى إلى اختلافات معنوية فى نسبة الفطريات المصاحبة للحبوب وكذلك التركيب الكيميائى للحبوب المخزنة مقارنة بالحبوب المخزنة تحت ظروف درجة الحرارة المحيطة (الغرفة) والمقدرة فى بداية التخزين (الكنترول) . وكانت الفطريات المصاحبة والمعرفة على حبوب الذرة الرفيعة باستخدام إختبار صحة البذور هى فيوزاريوم فيرتيسليوتس - فيوزاريوم سيميتيكتم ، فيوزاريوم أوكسيسبوريم وكيورفيورلاريا لوناتا ، اسبرجلس نيجر ، واسبرجلس فلافس ، بنسيليوم ، الترناريا الترناتا ، الترناريا سولانى ، بابيولارس سورجيكولا ، دريشليرا أوريزا وابيكوكم نيجرم . وبينت النتائج أن أعلى تكرار للفطريات المصاحبة لحبوب الذرة الرفيعة وجدت فى العينات المخزنة فى عبوات البلاستيك السميك تحت درجة حرارة الغرفة بعد ستة أشهر من التخزين يليها العينات المخزنة فى العبوات المصنوعة من الورق حيث كان عدد الفطريات الكلي في الحالتين هو ١٢٩ ، ١٠٩.٣٣ على التوالى بينما كانت ٧٨.٦٧ فى حالة التخزين فى عبوات مصنوعة من البلاستيك المنسوج وبالنظر إلى المكونات الكيميائية لحبوب الذرة الرفيعة فإن النتائج المتحصل عليها بينت أن التخزين على درجة حرارة الغرفة عموماً أدى إلى النقص فى الألياف الخام والرماد والزيت والبروتين الخام ونسبة الإنبات وجود الزيت بينما زادت الأحماض الدهنية الحرة ودرجة الحموضة خصوصاً عند التخزين فى عبوات البلاستيك السميك وفى نفس هذه الظروف من التخزين قلت وزن المائة حبة وزادت نسبة الإصابة بالفطريات مقارنة بالكنترول (عند بداية التخزين) . وخلاصة القول فإن تخزين حبوب الذرة الرفيعة فى عبوات البلاستيك المنسوج تحت درجة حرارة منخفضة (٥-٦ مْ) كان مناسبة جداً وأدى إلى انخفاض نسبة الإصابة بفطريات المخزن وحافظ على المكونات الكيميائية للحبة وجودة الزيت بها .

لذلك فإن درجة الحرارة والرطوبة النسبة وعبوات التخزين المناسبة من الاحتياجات الهامة لنجاح التخزين

~~تأثير عبوات التخزين المختلفة على الفطريات المصاحبة لحبوب السورجم وكذلك التركيب الكيماوى لها~~

~~*محمد السيد عبدا لله ، **سليمان محمد يوسف المغازى ،**سمر صبحى عبدا لعزيز السيد~~

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~~الملخص العربى~~

~~وجد أن تخزين حبوب السورجم تحت درجة حرارة ألغرفه عموما يؤدى إلى انخفاض نسبة كل من البروتين الخام والألياف الخام والرماد والزيت وجودة الزيت ووزن المائة حبه في الحبوب المخزنة وخاصته عند التخزين في عبوات مصنوعة من البولي ايثيلين الثقيل ، وتحت الظروف ألسابقه أيضا زادت نسبة الاصابه الكلية بمسببات عفن حبوب السورجم . وعلى الجانب الأخر فقد وجد أن التخزين تحت درجة حرارة من ١٠ ـ ١٢ درجه مئوية في عبوات مصنوعة من البولي ايثيلين المنسوج أدى إلى انخفاض قليل في نسبة المكونات الكيميائية للحبوب ووزن المائة حبه ، كذلك كانت الزيادة قليله في نسبة الاصابه بمسببات عفن حبوب السورجم المخزنة لمدة ستة واثني عشره شهرا . وفوق ذلك فان اقل نسبة أصابه بمسببات عفن حبوب السورجم تم الحصول عليها بالتخزين في عبوات مصنوعة من البولي ايثيلين المنسوج وتحت درجة حرارة من ٥ ـ ٦ درجه مئوية في كل من فترات التخزين المختبرة . ولكن العكس كان صحيحا عند تخزين حبوب السورجم في عبوات التخزين الأخرى وخاصته في المصنوعة من البولي ايثيلين الثقيل . وفي النهاية يمكن القول بان تخزين حبوب السورجم في عبوات مصنوعة من البولي ايثيلين المنسوج وتحت درجة حرارة من ٥ ـ ٦ درجه

مئوية كان مناسبا وادي إلى تجنب زيادة نسبة الإصابه بمسببات عفن حبوب السورجم وكذلك أدى إلى تجنب الفقد الكبير في المكونات الكيمائية للحبوب وتجنب التدهور في جودة الزيت في الحبوب المخزنة.

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قام بتحكيم البحث

أ.د/ محمد الششتاوى محمد عبد ربة كلية الزراعة - جامعة المنصورة

أ.د/ محمد محمد عمر خليفة مركز البحوث الزراعية

Table (1): The role of Effect of package kind types on seed borne fungi of sorghum under and different storage temperature conditions on decreasing of sorghum seed rots disease after six 6 months and twleve 12 months of storage period using susceptible hybrid 888.

Storage condition	Package Typekinds	*F. usarium verticillioides*	*F. semitectum*	*F. oxysporium*	*C. urvularia lunata*	*Aspergillus niger*	*A. flavus*	*Penicillium sp.*	*Al. ternaria solani*	*A. alternata*	*Bipolaris sorghicolaB. sorghicola*	*N. Drechslera oryzae*	*E. picoccum nigrum*	Total
	Frequency of fungal species associated with sorghum grains													
	After six 6 months of storage													
Under Rroom temperature 25±3 °C	HDP*	18.67b**	14.33 a	8.33 a	11.67 a	15.33 a	12.67 a	8.33 a	11.33 a	10.67 a	3.00 bc	8.33 a	9.67 a	129.00 a
	PP	16.67c	11.33 bc	6.33 b	11.33 a	12.67 b	7.67 c	7.67 a	10.67 ab	8.67 b	2.33 cd	6.33 b	7.67 b	109.33 b
	WP	14.33d	7.67 d	4.67 c	8.67 cd	7.67 cd	5.67 de	4.67 b	7.33 c	6.33 cd	1.67 de	4.67 cd	5.33 c	78.67 c
Refrigerator Under 10-12°C	HDP	16.33c	12.33 b	6.33 b	9.33 bc	11.33 b	10.67 b	7.33 a	9.33 b	8.67 b	3.67 b	4.33 de	8.33 ab	109.00 b
	PP	15.67dc	10.33 c	4.33 c	8.33 cd	8.67 c	6.33 d	4.67 b	7.67 c	7.33 c	1.67 de	3.67 def	3.67 cd	78.33 c
	WP	13.33d	6.33 e	3.67 c	7.33 de	7.33 cd	5.67 de	2.33 c	5.67 de	6.33 cd	0.67 e	2.33 fg	2.67 d	62.00 d
Refrigerator Under 5-6°C	HDP	21.33a	5.33 ef	8.67 a	10.33 ab	12.33 b	12.67 a	8.33 a	9.67 b	10.33 a	5.33 a	5.67 bc	9.33 ab	126.33 a
	PP	14.67d	4.33 f	4.67 c	6.67 ef	6.33 d	4.67 ef	3.33 bc	6.67 cd	6.33 cd	1.03 e	2.67 fg	3.33 d	65.67 d
	WP	12.33e	5.67 e	3.67 c	5.33 f	4.67 e	3.67 f	2.67 c	4.67 e	5.33 d	0.67 e	1.67 g	2.33 d	51.33 e
Control (At zero time)		14.33d	5.67 e	4.33 c	7.33 de	7.67 cd	5.67 de	2.33 c	6.33 cd	5.67 d	1.03 e	3.33 ef	4.00 cd	67.67 d
	After Twelve 12 months of storage													
Room temperature 25±3 °CUnder room temperature	HDP	19.33 b	15.33 a	9.33 a	12.33 a	19.33 a	17.33 a	13.67 a	12.67 a	11.67 a	3.33 bc	10.00 a	10.33 a	154.67 a
	PP	17.67 c	11.67 b	7.00 bc	12.33 a	14.33 b	9.33 c	9.67 b	11.33 ab	9.33b	2.67 bcd	7.33 b	8.67 b	121.33 d
	WP	16.67 c	8.33 c	5.67 cd	9.33 bc	10.33 c	6.00 e	6.00 c	8.67 de	8.33b	2.00 c-f	5.33 c	6.00 c	94.00 e
Refrigerator 10-12°CUnder 10-12°C	HDP	21.00 a	11.67 b	7.33 b	10.33 b	15.33 b	14.67 b	9.67 b	10.33 bc	9.33b	4.00 b	5.33 cd	9.33 ab	128.00 c
	PP	14.67 d	8.33 c	5.67 cd	9.33 bc	9.67 cd	8.00 cd	5.67 c	9.00 cd	8.67b	2.33 cde	4.03 de	4.33 d	89.67 e
	WP	12.67 e	6.33 d	4.33 d	8.33 cd	8.33 de	6.00 e	2.67 e	6.33 f	7.33bc	1.03 ef	2.67 ef	3.33 de	69.00 f
Refrigerator 5-6°CUnder 5-6°C	HDP	21.67 a	12.33 b	9.33 a	10.33 b	15.67 b	15.33 b	10.33 b	10.67 b	9.67b	5.67 a	5.67 c	9.33 ab	137.33 b
	PP	10.33 f	5.67 de	5.03 d	7.67 d	8.67 de	6.33 de	4.67 cd	7.33 ef	8.33b	1.33 def	3.33 ef	3.67 de	70.67 f
	WP	9.33 f	4.67 e	4.67 d	6.00 e	7.33 e	4.67 e	3.67 de	6.33 f	6.00c	0.67 f	2.33f	2.33 e	57.33 g
Control (At zero time)At zero time		14.33 d	5.67 de	4.33 d	7.33 de	7.67 e	5.67 e	2.33 e	6.33 f	5.67c	1.03 ef	3.33 ef	4.00 d	67.67 f

*HDP = High density polyethylene package, PP = Paper package, WP = Woven polyethylene package

**Mean values followed by the same letter(s) in each column do not differ significantly according to Duncan's test (*P ≤ 0.05*);

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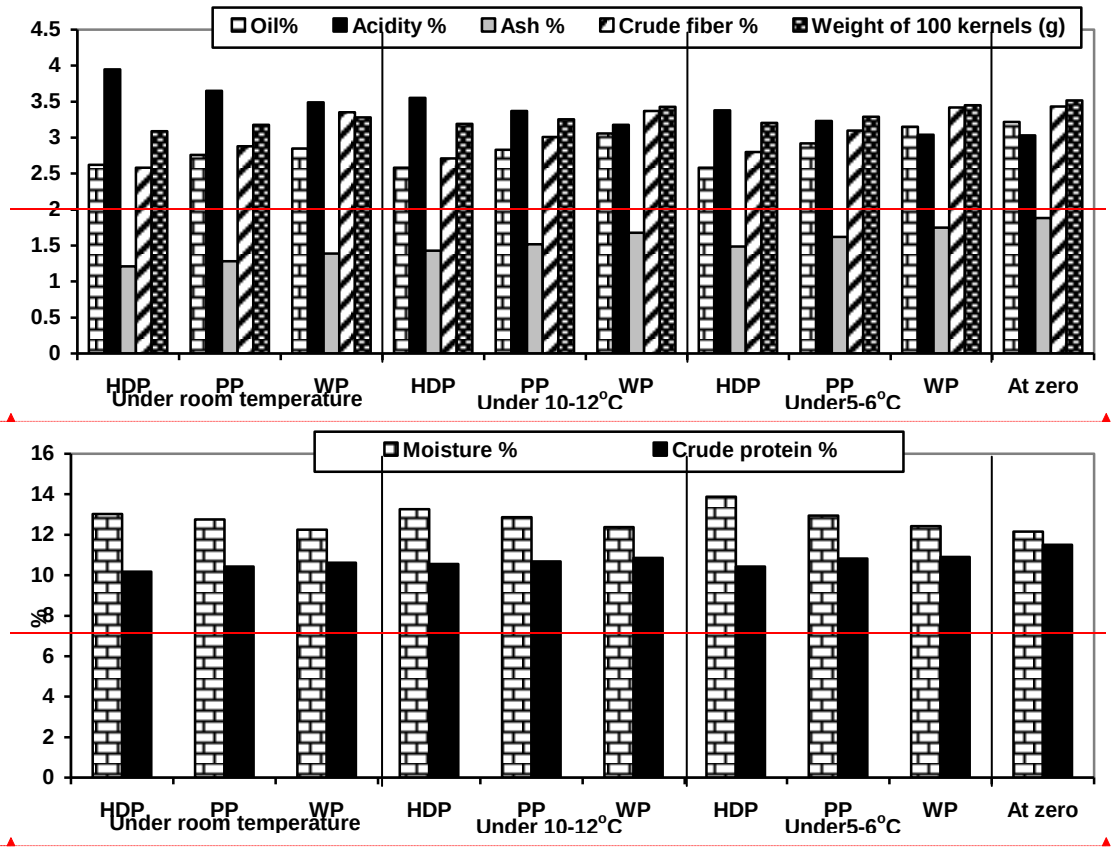

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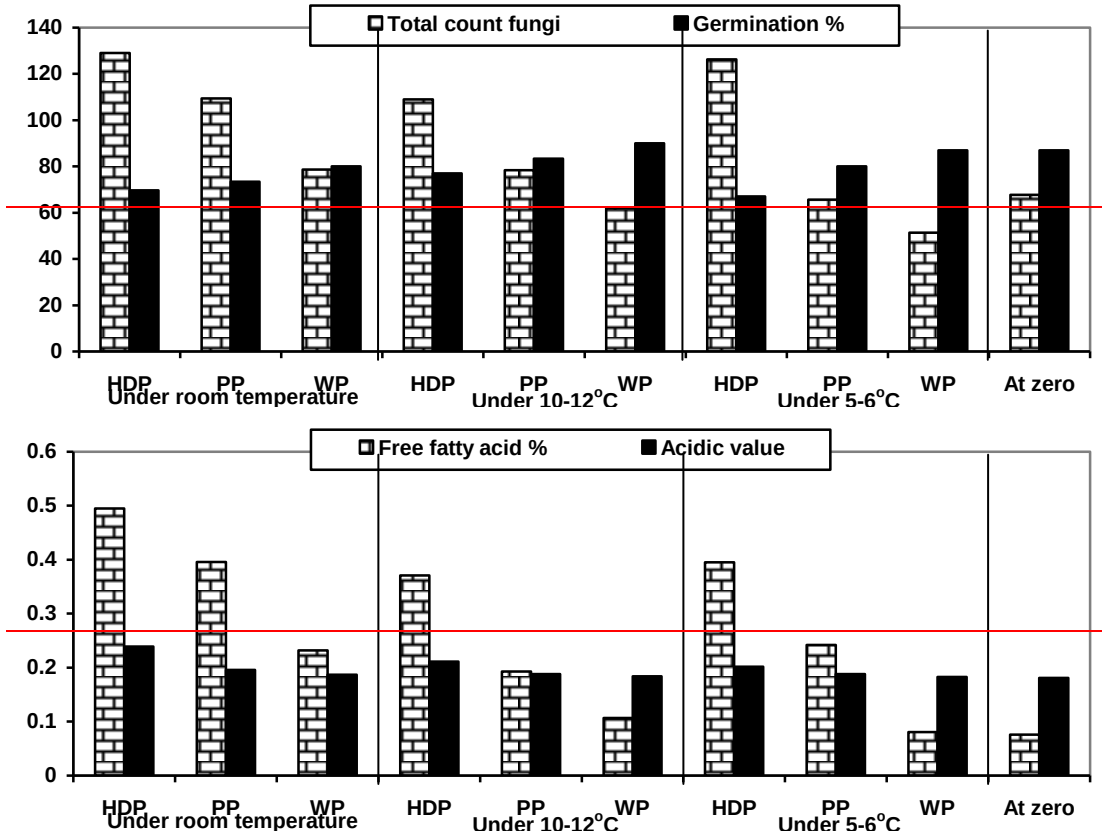

Fig. (1): Effect of storage conditions, storage period (six months) and kind of storage package on sorghum seeds rot causal organisms count and on their chemical component using hybrid 888

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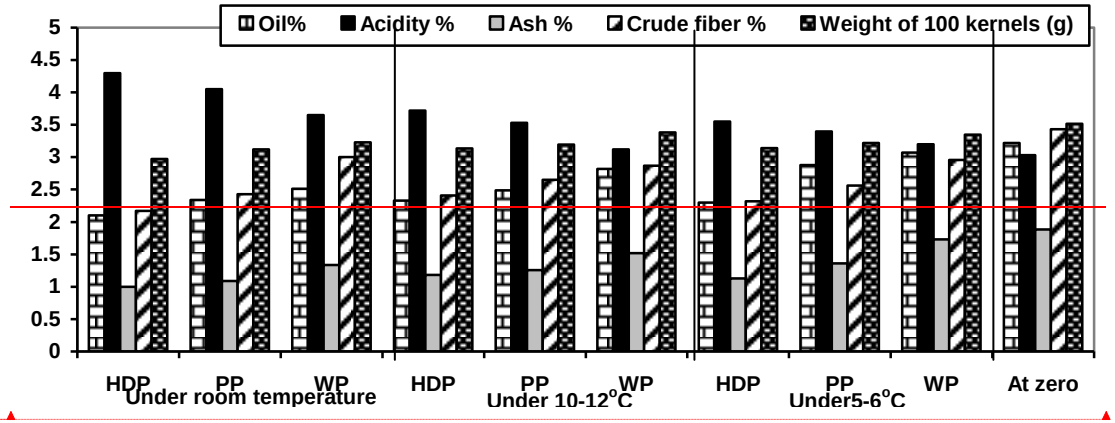

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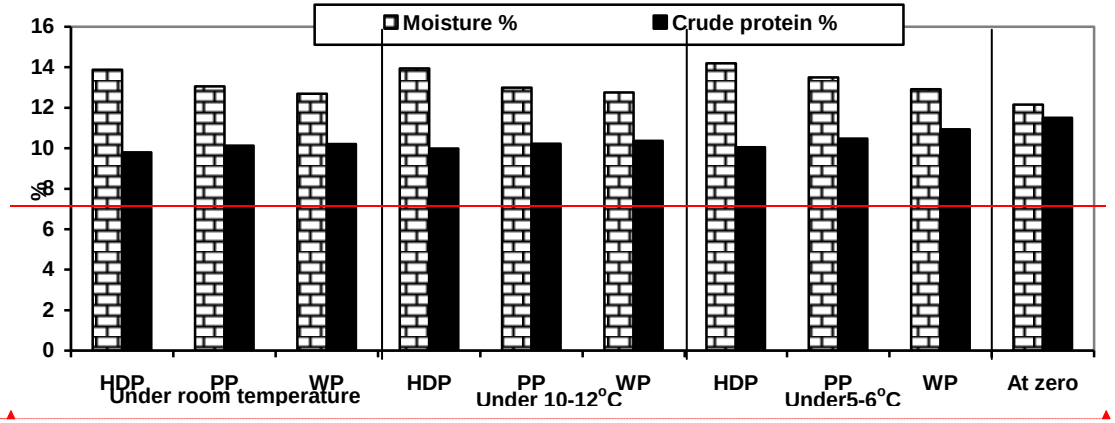

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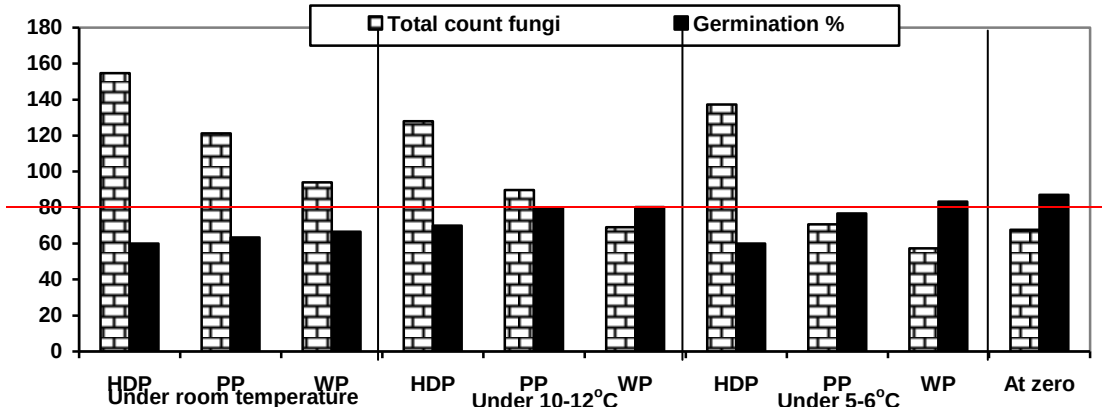

Fig. (2): Effect of storage conditions, storage period (twelve months) and kind of storage package on sorghum seeds rot causal organisms count and on their chemical component using hybrid 888

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Table (2): Effect of package types on seed borne fungi and chemical component of sorghum seed hybrid 888 under different temperature conditions after 6 and 12 months of storage ~~Effect of storage conditions, storage periods (six months and twelve months) and kind of storage package on sorghum seeds rot causal organism count and on their chemical component using hybrid 888.~~

Storage condition	Kind of package	Total count fungi	Germ-ination %	Moisture %	Crude protein %	Oil %	Free fatty acids %	Acidity %	Acidic value (AV)	Ash%	Crude fiber %	Weight of 100 kernels (g)
		After 6 months of storage~~Six months of storage~~										
Room temperature 25±3 °C~~Under room temperature~~	HDP	129.00 a	69.67 g	13.03 bc	10.18 d	2.62 f	0.495 a	3.950 a	0.239 a	1.210 j	2.580 g	3.090 h
	PP	109.33 b	73.33 e	12.75 cd	10.43 c	2.76 e	0.396 b	3.650 b	0.196 bc	1.280 i	2.880 d	3.177 g
	WP	78.67 c	80.00 d	12.25 e	10.62 bc	2.85 cd	0.232 c	3.490 d	0.187 bc	1.387 h	3.850 b	3.279 d
Refrigerator 10-12°C~~Under 10-12°C~~	HDP	109.00 b	77.00 e	13.27 b	10.56 c	2.58 f	0.371 b	3.550 c	0.211 b	1.430 g	2.780f	3.191 fg
	PP	78.33 c	83.33 c	12.86 bc	10.68 bc	2.83 de	0.193 c	3.370 e	0.188 bc	1.520e	3.010 c	3.252 e
	WP	62.00 d	90.00 a	12.38 de	10.85 b	3.06 b	0.107 d	3.180 g	0.184 c	1.680 c	3.370 b	3.427 c
Refrigerator 5-6°C~~Under 5-6°C~~	HDP	126.33 a	67.00 h	13.88 a	10.43 c	2.58 f	0.395 b	3.380 e	0.202 bc	1.487 f	2.800 e	3.205 f
	PP	65.67 d	80.00 d	12.95 bc	10.83 b	2.92 c	0.242 c	3.230 f	0.188 bc	1.620 d	3.100 c	3.288 d
	WP	51.33e	87.00 b	12.42 de	10.90 b	3.15 a	0.081 d	3.040 h	0.183 c	1.750 b	3.420 a	3.451 b
Control (At zero time)~~At zero time~~		67.67 d	87.00 b	12.15 e	11.50 a	3.22 a	0.076 d	3.030 h	0.181 c	1.883 a	3.430 a	3.515 a
		After 12 months of storage~~Twelve months of storage~~										
Room temperature 25±3 °C~~Under room temperature~~	HDP	154.67 a	60.00 h	13.88 b	9.80 e	2.10 h	0.499 a	4.300 a	0.279 bc	1.000 j	2.170 h	2.970 e
	PP	121.33 d	63.33 g	13.05 d	10.13 d	2.34 f	0.483 a	4.050 ab	0.275 bcd	1.090 i	2.430 f	3.120 d
	WP	94.00 e	66.67 f	12.69 f	10.21 d	2.51 e	0.263 c	3.650 bc	0.257 cde	1.333 e	3.000 b	3.230 c
Refrigerator 10-12°C~~Under 10-12°C~~	HDP	128.00 c	70.00 e	13.95 b	9.98 de	2.33 f	0.396 b	3.720 bc	0.292 b	1.180 g	2.410 f	3.134 d
	PP	89.67 e	80.00 c	12.99 de	10.22 cd	2.49 e	0.198 d	3.530 cde	0.262 cde	1.257 f	2.650 d	3.196 cd
	WP	69.00 f	80.33 c	12.76 f	10.36 c	2.82 d	0.143 e	3.120 ef	0.251 de	1.520 c	2.867 c	3.383 b
Refrigerator 5-6°C~~Under 5-6°C~~	HDP	137.33 b	60.00 h	14.20 a	10.05 d	2.30 g	0.393 b	3.550 cd	0.319 a	1.130 h	2.320 g	3.140 d
	PP	70.67 f	76.67 d	13.50 c	10.47 c	2.88 c	0.271 c	3.400 c-f	0.278 bc	1.360 d	2.560 e	3.222 c
	WP	57.33 g	83.33 b	12.92 e	10.94 b	3.07 b	0.093 f	3.200 def	0.242 e	1.730 b	2.957 b	3.350 b
Control (At zero time)~~At zero time~~		67.67 f	87.00 a	12.15 g	11.50 a	3.22 a	0076 f	.030 f	0.181 f	1.883 a	3.430 a	3.515 a

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* HDP = High density polyethylene package, PP = Paper package, WP = Woven polyethylene package

**Mean values followed by the same letter(s) in each column do not differ significantly according to Duncan's test ($P \leq 0.05$).

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~~HDP = High density polyethylene package, PP = Paper package, WP = Woven polyethylene package~~

These results were in the same line with recorded by El-Aidy *et al.* (2001) and EL-Sayed, Soad and Tolba (2005). They found that, the germination percentages affected by interaction of storage periods and package materials, the seeds which stored in woven polyethylene packages recorded the highest germination values and lowest decrease in seeds compounds (i.e. crude protein, crude fiber, ash and oil quality [it's decrease by increase free fatty acid (FFA) and acidity value (AV)], as well as increasing weight of 100 kernels. They added that, percentage of fungal infection of maize grains were positively correlated with grains content of free fatty acid (FFA), acidic value (AV) and acidity. In the reverse, the percentage of fungal infection was negatively correlated with maize grains contents of crude fiber, endosperm, ash and oil.

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تأثير عبوات التخزين المختلفة على الفطريات المصاحبة لحبوب السورجم وكذلك التركيب الكيماوى لها

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الملخص العربى

وجد أن تخزين حبوب السور جم تحت درجة حرارة ألغرفه عموما يؤدى إلى انخفاض نسبة كل من البروتين الخام والألياف الخام والرماد والزيت وجودة الزيت ووزن المائة حبه في الحبوب المخزنة وخاصته عند التخزين في عبوات مصنوعة من البولي ايثيلين الثقيل ، وتحت الظروف السابقه أيضا زادت نسبة الاصابه الكلية بمسببات عفن حبوب السور جم . وعلى الجانب الأخر فقد وجد أن التخزين تحت درجة حرارة من ١٠-١٢ درجه منوية في عبوات مصنوعة من البولي ايثيلين المنسوج أدى إلى انخفاض قليل في نسبة المكونات الكيمائية للحبوب ووزن المائة حبه ، كذلك كانت الزيادة قليله في نسبة الاصابه بمسببات عفن حبوب السور جم المخزنة لمدة ستة واثني عشره شهرا. وفوق ذلك فان اقل نسبة أصابه بمسببات عفن حبوب السور جم تم الحصول عليها بالتخزين في عبوات مصنوعة من البولي ايثيلين المنسوج وتحت درجة حرارة من ٥- ٦ درجه منوية في كل من فترات التخزين المختبرة . ولكن العكس كان صحيحا عند تخزين حبوب السور جم في عبوات التخزين الأخرى وخاصته في المصنوعة من البولي ايثيلين الثقيل . وفى النهاية يمكن القول بان تخزين حبوب السور جم في عبوات مصنوعة من البولي ايثيلين المنسوج وتحت درجة حرارة من ٥-٦ درجه منوية كان مناسبا وادي إلى تجنب زيادة نسبة الاصابه بمسببات عفن حبوب السور جم وكذلك أدى إلى تجنب الفقد الكبير في المكونات الكيمائية للحبوب وتجنب التدهور في جودة الزيت في الحبوب المخزنة .