AEJAES
AEJAES
AEJAES
AEJAES

Effect of Foliar Application Withtrace Elements Application, Potassium Fertilization and Storage Methods on the Characteristics of Storage Ability of Three Onion (*Allium cepa* L.) Cultivars Grown under Sohag Provinceconditions

H.A. Obiadalla-Ali, K.A.A. El-Shaikh and Z. Sedra Amal

Department of Horticulture, Faculty of Agriculture, Sohag University, Sohag 82786, Egypt

Abstract: This study was carried out at the Experimental Farm and Laboratory, Faculty of Agriculture, Sohag University, Sohag, Egypt during two successive winter seasons, 2011/2012 and 2012/2013 to investigate the effect of spraying micronutrients and potassium fertilization on the characteristics of storage ability of three cultivars of onion (Improved Giza 6, Giza 20 and Shandaweel 1) grown under Sohag conditions Three times of foliar trace elementsapplication (control "without foliar", once, twice and three times)and four rates of potassium fertilizer (Zero, 52.5, 105 and 157.5kg feddan^{-1}, one feddan = 0.42ha) were used in this study.The new Duncan's multiple range tests showed that themost storage studied characters were affected significantly by foliar application with trace elements, where the lowest decay% were obtained from three times foliar application with trace elements on Giza 20 and Shandaweel 1 cultivars in both seasons and only in the first season on Improved Giza 6 cultivar. Moreover, some storage studied characters were affected significantly by potassium fertilizer, where the highest potassium rate (150 kgK_2O feddan^{-1}) produced the lowest sprouting% on Giza 20 cultivar in both seasons. In addition, the most storage studied characters were affected significantly by storage methods, where the lowest sprouting%, decay% and weight loss% were obtained from plastic nets bags in all cultivars. Some storage studied characters were significantly affected by some interactions among factors under studies. The interaction among trace elements application, potassium fertilizer rate and storage methods, had no significant influence decay% on all cultivars in both seasons. The interaction among trace elements application, potassium fertilizer rate and storage methods, had a significant influence sprouting%, weight loss% on Shandaweel 1 cultivar in both seasons and only in the first season, respectively.

Key words: Micronutrients · K rates · Onion · Cultivar · Kraft paper bags · Perforated polyethylene bags · Spraying

INTRODUCTION

Onion (*Allium cepa* L.) is one of the main vegetable crops in the world. The cultivated area in the world is about 3.642.000 hectare (about 8.671.428 feddan, one feddan =0.42ha). The annual world production of onion is 74.250.809 tones and Egypt ranked 1st among Arab and African countries and 6th in the world in the production with an area of 600 thousand hectares and production of 2.081.000 tones [1]. Sohag governorate produced 331.000 tones represented 15.9% from total production as mentioned by the yearly book of Economics and Statistics [2].

It is one of the most important crops in Egypt for consumption, processing and exportation. It is produced almost all over the country but most of area is concentrated in Sohag Governorate. It contains carbohydrate, protein, vitamin A, thiamine, riboflavin, niacin, ascorbic acid [3] beta-carotene and lachrymatic compounds having antioxidant activity that helps to fight against cancer and chronic diseases [4, 5]. The green leaves, immature and mature bulbs are eaten raw in the form of salad or used in preparation of staple dishes [6]. Sandy soils are characterized with poor nutrient (including micronutrient) and unfavorable environmental condition which negatively affect growth and productivity of

Corresponding Author: Hazem A. Obiadalla-Ali, Department of Horticulture, Faculty of Agriculture, Sohag University, Sohag, Egypt. E-mail: drhazemaoa@yahoo.com.

vegetables including onion plants. Foliar spray of micronutrients was performed with a reasonable success in Egypt on several crops in the Nile Valley, the Nile Delta and the adjacent reclaimed soils [7-9]. The productivity of onion cultivars is mostly affected by different cultural practices i.e. application of micronutrients and potassium fertilizer [10]. These factors are the main limiting ones which affect the production of such cultivar.

Storage of bulbs after harvest is crucial to ensure availability during off-season. Many cultivars don't keep long in ambient storage because they tend to weight loss, decay shortly and sprouting after harvest. Also, due to poor storage facilities, onion breakdown within 2–4 months after harvest is a common phenomenon [11]. Nevertheless, storage of some cultivars for more than 6 months under ambient conditions is possible.Kariukiand Kimani, [12] suggested that, where possible, selection of long storing cultivars is the best way of improving keeping quality of onions.

Since, the information on foliar application with trace elements and potassium fertilizers of onion cultivars is low in respect of storage ability. Therefore, the present study was conducted to investigate the effects of foliar application with trace elements and potassium fertilizer on the characteristics of storage ability of three onion cultivars grown under Sohag Provinceconditions.

MATERIALS AND METHODS

Location: The fieldand storage investigation were carried out at the Experimental Farm and laboratoryof the Faculty of Agriculture, Sohag University, Sohag, Egypt during 2011/2012 and 2012/2013 winter seasons under newly reclaimed sandysoil. One soil sample (0-45 cm) was randomly taken form soil before transplanting, air dried, crushed, sieved and used to determine, the chemical and physical analysis of the experimental soil in the two seasons are presented in Table 1.

Experimental Details: Three Onion cultivars (Improved Giza 6, Shandaweel 1 and Giza 20) were used in this study. The source of this cultivars are Agricultural Research Center, Shandaweel Research Station, Onion Research section, Sohag, Egypt.In the field and during the growth three times of foliar application of micronutrients Fe (4.5%), Cu (1%), Mn (5%) and Zn (3.6%) with a dose of 200mg $600l^{-1}$ $feddan^{-1}$, (control "without foliar", once, twice and three times foliar) were applied. Also, four rates of potassium fertilizer (Zero, 52.5, 105 and 157.5kg $feddan^{-1}$, one feddan= $4200m^2$ i.e.0.42ha) as potassium sulfate (K_2O 48%) were applied as two doses; the first was added at 30 days after transplanting (DAT) (as one-third of the amount) and the second dose was supplied at 90 DAT (as the remaining two-thirds of the amount).Onion plants were foliar sprayed with an aqueous solution of micronutrients with a dose of three times in 30 days interval starting at 30 DAT. Distilled water was served as control treatment. Aqueous solutions of micronutrients Fe, Cu, Mn and Zn were freshly prepared using a chelating form known under the commercial name of Agro-Fe Fe(4.5%), Agro-Zn Zn Agro- (3.6%), Cu (1%) and Mn (5%) with a dose of 200g600 $litter^{-1}feddan^{-1}$. In addition, few drops of STICKY® as a wetting and sticky agent were added to spraying solution. All foliar sprays were done in the morning using a hand pressure. Sprayer was covered all leaves of plant with foliar spraying solution. All agricultural chemicals used for foliar application treatments were obtained from AGRICO International Co., Egypt, (www.agricointernational.com).

Each plot received equal number of onion transplants as well as ridges. The experimental plots were randomly assigned in a randomized complete block design with three replicates and every replicate consisted of sixteen plots. In the storage experiment micronutrients were assigned in the main plot while the potassium fertilizer rates were fixed in the sub plot and the storage methods were arranged in the sub-sub plot. Three different storage methods (Kraft paper bags, perforated polyethylene bags and plastic nets bags) were used. Bulbs harvested during two successive seasons were subjected to a storage test. After harvesting, the tops were removed from the bulbs followed by curing of the bulbs for 10–14 days by spreading them on the floor in a storeroom. After curing period, samples of marketable yield from each cultivar

Table 1: Soil characterization at the experimental site

Chemical properties	E.C (1:5) dSm^{-1}	pH (H_2O) (1:2.5)	$CaCO_3$ (%)	O.M (%)	N %	P_2O_5 ppm	K_2O ppm	Fe ppm	Mn ppm	Zn ppm	Cu ppm
	0.15 SS	7.73 SA	11.27 H	2.51 L	0.21 L	9.3 M	115.2 L	2.9 D	0.40 D	0.33 D	0.79 H
Physical Properties	Sand %	Silt %	Clay %	Soil Texture							
	47.18	23.12	29.70	Sandy-Clay loam							

SS: Slightly Saline, SA: Slightly Alkaline, H: High, L: Low, M: Moderate, D: Deficient

were selected for uniformity in size and shape. Nine hundred bulbs from each cultivar were taken, cleaned and placed in three different bags (Kraft paper bags, perforated polyethylene bags and plastic nets bags). All samples were kept under normal storage conditions (room temperature) for six months in three replications. The bulbs were examined for weight loss, decay and sprouting every month. Component weight losses due to rotting, sprouting and respiration were separated. All rotten and sprouted bulbs were removed from the bags each time data were taken and the observation continued for 6 months.

Data Collection

Storability Characters: The following characters were recorded at 30 days intervals.

A- Percentage of weight loss calculated as:

$$\text{Weight loss\%} = \frac{\text{Weight loss of bulb}}{\text{Total bulb weight at beginning of storage}} \times 100$$

B- Percentage of decay bulbs calculated as:

$$\text{Decay\%} = \frac{\text{No. of decay bulb}}{\text{Total No. of bulb at beginning of storage}} \times 100$$

C - Percentage of sprouted bulbs calculated as calculated as:

$$\text{Sprouting\%} = \frac{\text{No. of sprouting bulb}}{\text{Total No. of bulb at beginning of storage}} \times 100$$

Statistical Analysis: Data obtained were statistically analyzed and treatments means were compared [13].

RESULTS AND DISCUSSION

Weight loss (%)

Effect of Storage Methods: Storage methods exerted a significant influence on weight loss%on all cultivars in both seasons. The lowest percentage was obtained from Kraft paper bags in the first and second seasons, respectively. While, the highest percentage was obtained from Plastic nets bags in the first and second season, respectively (Tables 2, 3 and 4). These results are in conformity with those obtained byJones and Mann, 1963[14], who reported that successful onion storage depends on the choice of storage methods. The obtained results are also in harmony with those reported by Ullah *et al*. and Tekalign *et al*., [15, 16] who observed that onion bulb storage weight losses were increment with storage time. Similar findings were reported byCurrah and Rabinowitch, [17], who indicated that weight loss in onion bulb could reach up to 5% of the total fresh weight over a storage period of second to six week. The results also concerted with those obtained byMsika and Jackson, [18], who observed that weight losses were between 2 and 5% per month in warm ambient storage in Zimbabwe. Similarly, Rubatzky and Yamagunchi, [19] indicated that during storage there was loss in dry matter and moisture as a result of translocation of carbohydrates for respiration process. Babatola and Lawal, [20] revealed that significant differences in weight loss of onion in relation to storage methodswhere, weight loss was least on slatted tray as compared with other storage structures. On contrary to the current findingDantata, [21] found non-significant effect of storage methods on storability of onion due to the bulbs were fully matured at harvest and well cured before storage and the storage temperature was ambient.

Effect of K-Fertilizer: K-fertilizer had significant influence on weight loss percentage only in the first season in all cultivars. These results are in agreement with those ofAhmed, *et al*. and Mansour, [22, 23] who revealed that application of potassium sulphate increased garlic bulb storability by reducing total weight loss than potassium chloride applied over two seasons. Similarly, Kale, [24] observed less onion bulb weight loss due to sulphate of potash, sheep manure and farm yard manure as compared to highest loss due to muriate of potash and urea respectively at all successive storage days. As well as, El-Sayed and El-Morsy, [25] recorded a reduced total weight loss of garlic bulbs at application of K80 kg ha^{-1}. On contrary to the current finding,Abu-Grab *et al*., [11] showed that application of potassium and phosphor had no effects on storage life of onions. In addition, Hewett, [26] revealed that poor management of fertilizers could increase physiological disorders of crops after harvest due to deficiencies of some minerals and toxicity of others which will lead to negative effect on the quality of crops.

Effect of Foliar Application with Trace Elements: Micronutrients foliar application had significant influence on weight loss percentage on Shandaweel 1 and Improved Giza 6 cultivars in both seasons and only in the first season, respectively (Tables 4 and 2). Similar results were obtained by Omran *et al*., [27], who revealed that applying micronutrients increased the storageability of onion bulbs. SimilarlyEl-Mansi and Sharaf El-Dien, [28] reported that spraying with copper at 50 ppm recorded minimum

Table 2: Effect of micronutrients, potassium fertilizer, storage methods and their interaction on weight loss for onion cultivar Improved Giza 6 inthe two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	39.06	44.99	50.19	44.74	39.26	45.87	49.43	44.86
	52.5	37.92	41.78	53.25	44.32	38.95	41.39	53.61	44.65
	105	34.83	36.60	44.62	38.68	33.70	36.02	47.36	39.02
	157.5	32.48	39.63	46.59	39.57	33.98	42.81	45.43	40.74
	Mean	36.07	40.75	48.66	41.82a	36.47	41.53	48.96	42.31a
Once	Zero	31.79	47.06	48.99	42.61	35.27	42.38	49.11	42.26
	52.5	33.47	41.97	50.09	41.84	32.96	39.64	44.17	38.93
	105	36.55	43.21	49.71	43.16	27.80	45.54	49.77	41.04
	157.5	28.38	35.76	43.55	35.89	25.32	36.59	54.34	38.75
	Mean	32.55	42.00	48.09	40.87ab	30.34	41.04	49.35	40.24a
Twice	Zero	34.37	42.33	49.29	42.00	31.00	46.15	49.74	42.30
	52.5	31.96	42.08	45.26	39.77	31.18	39.42	40.71	37.10
	105	29.30	46.24	47.90	41.15	39.26	45.01	50.94	45.07
	157.5	26.49	37.46	53.63	39.19	27.47	36.07	42.69	35.41
	Mean	30.53	42.03	49.02	40.52ab	32.23	41.66	46.02	39.97a
Three times	Zero	36.12	41.41	43.77	40.44	35.00	41.26	44.80	40.35
	52.5	29.65	35.71	39.79	35.05	30.95	36.62	38.91	35.49
	105	38.38	43.06	46.70	42.71	34.76	43.34	49.50	42.53
	157.5	32.83	37.88	49.28	39.99	32.34	40.08	50.72	41.05
	Mean	34.25	39.51	44.89	39.54b	33.26	40.32	45.98	39.85a
S/K	Zero	35.33	43.95	48.06	42.45a	35.13	43.92	48.27	42.44a
	52.5	34.77	42.28	47.23	41.42ab	33.88	42.48	49.39	41.92a
	105	33.25	40.38	47.10	40.24ab	33.51	39.27	44.35	39.04a
	157.5	30.05	37.68	48.26	38.66b	29.78	38.89	48.29	38.99a
Mean	33.35c	41.07b		47.66a	33.08c	41.14b	47.58a		
LSD 5% for:									
Potassium fertilizer (K):				3.68					3.66 Ns
Micronutrients (M):				2.15					3.41 Ns
KM:				6.10					6.06
Storage Methods (S)				1.70					1.87
KS:				2.84					Ns
MS:				Ns					Ns
KMS:				Ns					Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 3: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon weight loss for onion cultivar Giza 20 inthe two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer rate								
(M)	(K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	32.39	40.19	44.17	38.92	31.20	38.96	43.43	37.87
	52.5	34.19	38.78	44.25	39.07	32.27	39.99	45.91	39.39
	105	37.58	46.11	51.71	45.13	33.84	39.89	44.51	39.41
	157.5	33.10	38.44	42.06	37.87	40.17	44.87	53.52	46.19
	Mean	34.32	40.88	45.55	40.25a	34.37	40.93	46.84	40.71a
Once	Zero	20.72	32.58	43.25	32.19	36.29	44.88	53.63	44.94
	52.5	31.59	41.59	44.29	39.16	31.22	35.75	45.15	37.37
	105	34.16	40.16	43.16	39.16	26.72	37.64	46.76	37.04
	157.5	38.04	44.34	46.07	42.82	28.43	33.28	41.49	34.40
	Mean	31.13	39.67	44.19	38.33a	30.67	37.89	46.76	40.56a
Twice	Zero	34.88	40.22	50.69	41.93	29.04	31.11	35.54	31.90
	52.5	31.46	36.71	43.01	37.06	31.91	42.39	54.13	42.81
	105	29.04	34.85	46.17	36.69	31.49	36.36	39.04	35.63
	157.5	26.77	34.60	43.99	35.12	33.39	41.61	52.39	42.46
	Mean	30.54	36.60	45.97	37.70a	31.46	37.87	45.27	38.44a
Three times	Zero	26.32	30.01	35.79	30.71	39.42	41.40	46.69	42.50
	52.5	32.52	42.66	53.92	43.03	32.70	37.58	42.09	37.46
	105	31.19	36.04	38.66	35.30	41.72	42.92	44.01	42.88
	157.5	29.06	42.12	51.94	41.04	32.37	40.83	44.99	39.39
	Mean	29.77	37.71	45.08	37.52a	36.55	40.68	44.44	38.20a
S/K	Zero	32.44	39.93	46.37	39.58a	33.59	40.15	48.10	40.61a
	52.5	31.74	39.88	46.02	39.21a	33.99	39.09	44.82	39.30a
	105	28.58	35.75	43.48	39.07b	32.03	38.93	46.82	39.26a
	157.5	32.99	39.29	44.93	35.94a	33.44	39.20	43.58	38.74a
	Mean	31.44c	38.71b	45.20a		33.26c	39.34b	45.83a	
LSD 5% for:									
Potassium fertilizer (K):					2.49				2.88 Ns
Micronutrients (M):					2.85 Ns				3.39 Ns
KM:					4.13				4.66
Storage Methods (S)					1.99				1.52
KS:					Ns				2.54
MS:					Ns				Ns
KMS:					Ns				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 4: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon weight loss for onion cultivar Shandaweel 1 in the two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	42.170	46.177	47.817	45.388	36.120	43.957	46.797	42.291
	52.5	30.303	45.200	51.490	42.331	45.127	43.900	62.843	50.623
	105	41.677	46.177	54.643	47.499	41.413	48.677	61.087	50.392
	157.5	30.043	44.617	52.410	42.357	33.553	47.353	56.260	45.722
	Mean	36.048	45.543	51.590	44.39a	39.053	45.972	56.747	47.26a
Once	Zero	34.580	44.390	53.890	44.287	40.507	46.050	52.527	46.361
	52.5	36.603	46.037	55.427	46.022	37.957	41.347	49.083	42.796
	105	28.187	35.950	48.023	37.387	36.490	40.327	49.547	42.121
	157.5	38.153	40.807	42.643	40.534	35.600	38.937	43.850	39.462
	Mean	34.381	41.796	49.996	42.06ab	37.638	41.665	48.752	42.69b
Twice	Zero	31.660	40.770	44.130	38.853	38.333	45.400	54.260	45.998
	52.5	37.293	42.937	50.087	43.439	36.663	46.033	56.227	46.308
	105	36.817	40.040	48.803	41.887	25.493	36.267	48.793	36.851
	157.5	32.060	36.330	45.887	38.092	38.473	41.013	43.023	40.837
	Mean	34.458	40.019	47.227	40.568b	34.741	42.178	50.576	42.50b
Three times	Zero	37.393	40.913	44.297	40.868	38.047	41.090	45.743	41.627
	52.5	35.947	38.963	43.860	39.590	36.113	38.663	42.963	39.247
	105	34.930	41.113	45.187	40.410	35.227	41.393	45.457	40.692
	157.5	29.783	37.873	47.880	38.512	28.753	38.783	57.637	41.724
	Mean	34.513	39.716	45.306	39.85b	34.535	39.983	47.950	40.82b
S/K	Zero	35.037	43.284	50.216	42.85a	38.965	42.486	52.779	44.74a
	52.5	36.451	43.063	47.533	42.35ab	38.252	44.124	49.832	44.07a
	105	35.403	40.820	49.164	41.80ab	34.656	41.666	51.221	42.51a
	157.5	32.510	39.907	47.205	39.87b	34.095	41.522	50.193	41.94a
	Mean	34.85c	41.77b	48.53a		36.49c	42.45b	51.0a	
LSD 5% for:									
Potassium fertilizer (K):					2.64				3.33
Micronutrients (M):					3.39				3.66
KM:					4.37				5.52
Storage Methods (S)					1.75				2.34
KS:					Ns				Ns
MS:					Ns				Ns
KMS:					5.86				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

weight loss and sprouting percentage of bulbs during storage period. On contrary, micronutrients foliar application had no significant influence on weight loss percentage on Giza 20 cultivar in both seasons (Table 3). These results are in close conformity with the findings of Dantata, [21] who indicated that non-significant effect of micronutrients on this storage methods due to the bulbs were fully matured at harvest and well cured before storage and the storage temperature was ambient, not high enough to reduceweight.

Interaction Effect of Storage Methods, K-fertilizer Rate and Trace Elements Application: The interaction between storage methods, K-fertilizer rate and trace elements application had no significant influence weight loss percentage in Giza 6 and Giza 20 cultivars in both seasons (Tables 2 and 3). While, the interaction between storage methods, K-fertilizer rate and trace elements application had a significant influence weight loss percentage in Shandaweel 1 cultivar only in the first season (Table 4). Where, the highest percentage (55.427%) was obtained from Plastic nets bags when K-fertilizer applied at second rate and once applying foliar spraying of micronutrients.

Decay (%)

Effect of Storage Methods: Storage methods had a significant effect on decay percentage in all cultivars in both seasons. The lowest decay% was obtained from Kraft paper bags, while the highest% was obtained from Plastic nets bags (Tables 5, 6 and 7). These results are in agreement with those obtained byJones and Mann, [14], who showed that successful onion storage depends on the choice of storage methods. Our obtained results are also in harmony with those reported byAdamicki and Kepka, [29] who showed that rotting is additional factor in storage which deteriorate the quality of onion bulbs. These results coincide with those obtained byBrewster JL, 1994, Warid *et al*. and Brice *et al*., [30-32], who revealed that rotting is known to be the main causes of storage losses in onions. Similarly, Msuya *et al*., [33] showed that many cultivars do not keep long in ambient storage because they tend to rot shortly after harvest. As well as Abu *et al*., [34] showed that percentage rotten bulbs were 44% for bare non-concreted floor compared with 33% for bare concreted floor.

Effect of K- Fertilizer: K-fertilizer had significant influence on decay% in both seasons in Giza 6 cultivar (Table 5) and only in the second season in Shandaweel 1 (Table 7). The obtained results are in harmony with those reported byAhmed, *et al*. and Mansour, [22, 23], who revealed that application of potassium sulphate increased garlic bulb storability by reducing decay% than potassium chloride applied over two seasons. While K-fertilizer had no significant effect on decay% in both seasons in Giza 20 cultivar (Table 6). These results are in agreement with those reported byRabinowitch and Brewster [11], who showed that application of potassium and phosphor had no effects on storage life of onions. Moreover, Hewett, [26] revealed that poor management of fertilizers could increase physiological disorders of crops after harvest due to deficiencies of some minerals and toxicity of others which will lead to negative effect on the quality of crops.

Effect of Foliar Application with Trace Elements: Micronutrients foliar application had significant influence on decay% on Giza 20 and Sandaweel 1 cultivars in both seasons (Tables 6 and 7), but only in the first season on Improved Giza 6 cultivar (Table 5). Similar results were obtained by [35] who reported that microelements have significant positive effect on storability of onion plants. As well asAbd El-Mawgoud *et al*., and Abd El-Samad, *et al*., [36, 37] indicated that zinc has positive significant effect on quality of onion. Similarly Omran *et al*, [27] found that application of micronutrients increased the storageability of onion bulbs.

Interaction Effect of Storage Methods, K-fertilizer Rate and Trace Elements Application: The interaction between storage methods, K-fertilizer rate and trace elements application had no significant influence on decay% on all cultivars in both season (Tables 5, 6 and 7). On the other hand, the interaction between storage methods, K-fertilizer rate had a significant influence on decay% only in the first season in Improved Giza 6 cultivar (Table 5) and in Shandaweel 1 cultivar in the second season (Table 7). While, the interaction between storage methods, K-fertilizer rate had no significant effects on decay% in Giza 20 cultivar in both seasons (Table 6).

In Improved Giza 6 cultivar the highest decay% (5.97%) was obtained from Plastic nets bags when k-fertilizer applied at second rate in the first season (Table 5). In Shandaweel 1 cultivar the highest decay% (3.311%) was obtained from Plastic nets bags when k-fertilizer applied at highest rate in the second season (Table 7).

Table 5: Effect of micronutrients, potassium fertilizer, storage methods and their interaction on decay% for onion cultivar Improved Giza 6 inthe two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	0.71	3.99	5.92	3.54	0.71	3.72	3.99	2.81
	52.5	2.02	4.14	6.86	4.34	1.37	2.37	5.39	3.04
	105	1.37	3.03	5.39	3.26	1.37	2.68	4.87	2.97
	157.5	2.02	3.99	5.57	3.86	2.68	3.64	5.41	3.91
	Mean	1.53	3.78	5.93	3.75a	1.53	3.10	4.91	3.18a
Once	Zero	2.37	3.77	6.09	4.07	1.75	2.40	5.62	3.26
	52.5	0.71	3.03	5.27	3.00	0.71	3.03	4.92	2.88
	105	0.71	1.71	5.74	2.72	0.71	1.71	5.41	2.61
	157.5	2.02	3.60	6.82	4.15	2.02	3.42	5.98	3.81
	Mean	1.45	3.03	5.98	3.49ab	1.30	2.64	5.48	3.14a
Twice	Zero	0.71	1.37	3.73	1.93	1.37	2.02	4.48	2.62
	52.5	2.02	3.87	5.76	3.89	0.71	3.52	4.71	2.98
	105	0.71	1.37	2.72	1.60	0.71	1.37	2.72	1.60
	157.5	2.64	2.98	5.04	3.55	2.37	2.98	4.60	3.32
	Mean	1.52	2.40	4.31	2.74ab	1.29	2.47	4.13	2.76a
Three times	Zero	0.71	0.71	2.37	1.26	0.71	1.37	2.37	1.48
	52.5	4.14	4.95	5.98	5.02	2.87	4.98	5.57	4.47
	105	1.71	2.64	5.47	3.27	1.37	1.71	5.42	2.83
	157.5	0.71	2.37	4.14	2.41	0.71	2.37	3.64	2.24
	Mean	1.82	2.67	4.49	2.99b	1.41	2.61	4.25	2.63a
S/K	Zero	2.22	4.00	5.97	4.06a	1.41	3.48	5.15	3.34a
	52.5	1.85	3.23	5.39	3.49a	1.95	3.10	4.91	3.32a
	105	1.13	2.46	4.53	2.71b	1.13	2.38	4.11	2.54b
	157.5	1.13	2.19	4.83	2.70b	1.04	1.87	4.61	2.50b
	Mean	1.58c	2.97b	5.18a		1.38c	2.71b	4.69a	
LSD 5% for:									
Potassium fertilizer (K):					0.78				0.77
Micronutrients (M):					0.99				0.80 Ns
KM:					1.29				1.28
Storage Methods (S)					0.46				0.39
KS:					0.77				Ns
MS:					Ns				Ns
KMS:					Ns				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 6: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon Decay% for onion cultivar Giza 20 in the two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	2.02	4.48	7.45	4.65	0.71	2.37	4.48	2.52
	52.5	0.71	2.02	7.47	3.40	0.71	4.71	5.10	3.51
	105	2.59	2.64	4.25	3.16	0.71	2.98	4.48	2.73
	157.5	0.71	1.71	4.87	2.43	2.21	4.25	6.36	4.27
	Mean	1.51	2.71	6.01	3.41a	1.09	3.58	5.11	3.26a
Once	Zero	0.71	3.64	4.48	2.94	1.37	4.09	6.78	4.08
	52.5	2.37	4.09	5.12	3.86	0.71	2.64	6.15	3.16
	105	0.71	3.72	4.98	3.14	1.37	2.37	4.95	2.90
	157.5	1.71	3.42	5.95	3.70	1.37	2.02	3.64	2.34
	Mean	1.38	3.72	5.14	3.41a	1.20	2.78	5.38	3.12a
Twice	Zero	0.71	1.71	7.12	3.18	0.71	0.71	2.87	1.43
	52.5	0.71	1.71	5.12	2.52	0.71	2.37	5.10	2.73
	105	0.71	2.41	4.19	2.44	0.71	0.71	3.25	1.56
	157.5	0.71	1.37	2.98	1.69	0.71	1.71	5.47	2.63
	Mean	0.71	1.80	4.85	2.46b	0.71	1.38	4.17	2.09b
Three times	Zero	0.71	0.71	3.25	1.56	0.71	1.37	4.71	2.26
	52.5	0.71	1.71	5.84	2.75	0.71	1.71	3.71	2.04
	105	0.71	1.37	3.25	1.78	0.71	0.71	2.98	1.47
	157.5	0.71	2.37	5.34	2.81	0.71	0.71	4.42	1.95
	Mean	0.71	1.54	4.42	2.22b	0.71	1.13	3.96	1.93b
S/K	Zero	1.13	2.39	5.89	3.13a	0.71	2.86	5.01	2.86a
	52.5	1.04	2.64	5.58	3.08a	1.25	2.18	4.97	2.80a
	105	0.96	2.22	4.79	2.65a	0.87	2.14	4.71	2.57a
	157.5	1.18	2.53	4.17	2.63a	0.87	1.69	3.92	2.16a
	Mean	1.08c	2.44b	5.10a		0.93c	2.22b	4.65a	
LSD 5% for:									
Potassium fertilizer (K):					1.19Ns				0.77 Ns
Micronutrients (M):					0.91				0.68
KM:					1.97				1.28
Storage Methods (S)					0.52				0.51
KS:					Ns				Ns
MS:					Ns				Ns
KMS:					Ns				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 7: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon Decay% for onion cultivar Shandaweel 1in the two successive seasons (2011/2012 and 2012/2013)

Micronutrients (M)	Potassium fertilizer rate (K) kg/feddan	First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
		1	2	3	Mean	1	2	3	Mean
Control	Zero	0.71	2.76	7.41	3.63	0.71	1.37	5.21	2.43
	52.5	0.71	1.71	5.30	2.58	1.37	1.71	4.75	2.61
	105	0.71	1.71	4.69	2.37	0.71	0.71	3.86	1.76
	157.5	1.37	4.62	7.49	4.49	0.71	1.71	4.71	2.38
	Mean	0.87	2.70	6.22	3.27a	0.87	1.38	4.63	2.29a
Once	Zero	0.71	1.37	4.75	2.28	0.71	0.71	1.98	1.13
	52.5	0.71	0.71	4.73	2.05	0.71	0.71	4.12	1.85
	105	1.37	1.98	7.03	3.46	0.71	0.71	2.21	1.21
	157.5	0.71	0.71	2.64	1.35	0.71	3.71	3.91	2.78
	Mean	0.87	1.19	4.79	2.28b	0.71	1.46	3.06	1.74a
Twice	Zero	0.71	0.71	3.91	1.78	0.71	0.71	3.91	1.78
	52.5	0.71	0.71	5.12	2.18	0.71	0.71	3.21	1.54
	105	0.71	0.71	2.92	1.45	0.71	0.71	2.37	1.26
	157.5	0.71	2.21	4.95	2.62	0.71	1.71	3.91	2.11
	Mean	0.71	1.09	4.23	2.18b	0.71	0.96	3.35	1.67a
Three times	Zero	0.71	0.71	3.91	1.78	0.71	0.71	0.71	0.71
	52.5	0.71	1.37	3.60	1.89	0.71	0.71	0.71	0.71
	105	0.71	1.71	4.22	2.21	0.71	0.71	0.71	0.71
	157.5	0.71	2.87	4.92	2.83	0.71	0.71	0.71	0.71
	Mean	0.71	1.66	4.16	2.01b	0.71	0.71	0.71	0.71b
S/K	Zero	0.87	2.60	5.00	2.82a	0.71	1.96	3.31	1.99a
	52.5	0.87	1.53	4.71	2.37a	0.87	0.96	3.20	1.67ab
	105	0.71	1.39	4.99	2.36a	0.71	0.87	2.95	1.51ab
	157.5	0.71	1.13	4.69	2.17a	0.71	0.71	2.29	1.23b
	Mean	0.79c	1.66b	4.85a		0,75b	1,12b	2,93a	
LSD 5% for:									
Potassium fertilizer (K):					0.78 Ns				0.58
Micronutrients (M):					0.94				0.80
KM:					1.29				Ns
Storage Methods (S)					0.62				0.47
KS:					Ns				0.78
MS:					Ns				Ns
KMS:					Ns				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Sprouting (%)

Effect of Storage Methods: Storage methods had a significant effect on sprouting percentage in all cultivars in both seasons. The lowest sprouting% was obtained from Kraft paper bags, while the highest% was obtained from Plastic nets bags (Table 8, 9 and 10). These results agreed with those reported byJones and Mann, [14] who reported that successful onion storage depends on the choice of storage methods. These results also are in harmony with those ofAdamicki and Kepka, [29] who showed that sprouting is additional factor in storage which deteriorate the quality of onion bulbs.Rahim *et al*., [38] revealed that storage techniques and conditions have great impact on the storage life of onion. In addition, Brewster, Warid *et al*., and Brice *et al*., [30-32] revealed that sprouting is known to be the main causes of storage losses in onions. Prevailing high temperatures and relative humidity have strong influence on bulb formation and storability yield of onions. This result is supported by work of Pak *et al*., and Henriksen and Hansen, [39, 40] who reported that slight increase in dry matter and accounted it to loss of moisture from the bulbs as well as to hydrolysis of fructans upon termination of the dormancy where the bulbs began to sprout.Wheeler *et al*., [41] revealed that sprouting in storage was associated with lower levels of total water-soluble solids in the center of bulbs which was mostly associated with the early harvest. The results are also in conformity with Vince *et al*., [42] who reported that sprouting in onion bulbs during storage due to too high a storage temperature and poorly cured onion bulbs.

On contrary to the current finding, Dantata, [21] found that the treatments effect on the percent number of sprouted bulbs is consistently not significant throughout the weeks of storage. The non-significant effect of storage methods on storability of onion due to the bulbs were fully matured at harvest and well cured before storage and the storage temperature was ambient, not high enough to induce sprouting.

Effect of K- Fertilizer: K-fertilizer had no significant influence on sprouting percentage on all cultivars in both seasons. These results are in agreement with those obtained byRabinowitch and Brewster [11] who showed that application of potassium and phosphor had no effects on storage life of onions.On the contrary,Ahmed, *et al*. and Mansour, [22, 23] revealed that application of potassium sulphate increased garlic bulb storability by reducing sprout percentage than potassium chloride applied over two seasons. These results may be due to the role of sulphur as a constituent of pungency substances, which is positively connected with the storability of bulbs. In addition, Hewett, [26] revealed that poor management of fertilizers could increase physiological disorders of crops after harvest due to deficiencies of some minerals and toxicity of others which will lead to negative effect on the quality of crops.

Effect of Foliar Application with Trace Elements: Micronutrients foliar application had no significant influence on sprouting percentage on Improved Giza 6 and Giza 20 cultivars in both seasons (Table 8 and 9). These results are in agreement with those obtained by Dantata, [21], who indicated that non-significant effect of micronutrients on storage methods due to the bulbs were fully matured at harvest and well cured before storage and the storage temperature was ambient, not high enough to induce sprouting. While, the micronutrients foliar application had significant influence on sprouting% onShandaweel 1 cultivar in both seasons (Table 10). These results are in close conformity with the findings of Metwally, [43] who found that micronutrients (Fe, Zn, Mn and Cu) exhibited very low percentage of sprouting in garlic in comparison with control. This is probably due to copper, which one of its components, known for reducing such an action. On the contrary, El-Mansi and Sharaf El-Dien, [28] showed that sprouting decreased by increasing micronutrients application. Whereas, spraying with copper at 50 ppm recorded minimum sprouting percentage of bulbs during storage period. As well asOmran *et al*., [27] found that application of micronutrients increased the storageability of onion bulbs.

Interaction Effect of Storage Methods, K-fertilizer Rate and Trace Elements Application: The interaction between storage methods, K-fertilizer rate and trace elements application had a significant influence sprouting percentage on Improved Giza 6 and Giza 20 cultivarsonly in the first season (Tables 8 and 9). While, the interaction between storage methods, K-fertilizer rate and trace elements application had a significant influence sprouting percentage on Shandaweel 1 cultivar in both seasons (Table 10). In Improved Giza 6 cultivar the highest percentage (4.01%) was obtained from Plastic nets bags when K-fertilizer applied at highest rate and without applying foliar spraying of micronutrients. In Giza 20 cultivar, the highest percentage (3.37%) was obtained from Plastic nets bags without K-fertilizer applied and one time applying foliar spraying of micronutrients.

Table 8: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon Sprouting% for onion cultivar Improved Giza 6 in the two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	1.37	1.37	2.02	1.59	0.71	1.37	3.64	1.91
	52.5	1.37	2.37	2.71	2.15	0.71	1.37	2.02	1.37
	105	0.71	2.02	3.73	2.15	0.71	1.37	3.03	1.70
	157.5	0.71	0.71	0.71	0.71	0.71	0.71	2.02	1.15
	Mean	1.04	1.62	2.29	1.65a	0.71	1.20	2.68	1.53a
Once	Zero	0.71	1.37	3.29	1.79	0.71	0.71	1.37	0.93
	52.5	0.71	1.37	2.02	1.37	1.37	1.71	3.03	2.04
	105	0.71	2.02	3.03	1.92	0.71	2.02	3.52	2.09
	157.5	0.71	1.37	2.02	1.37	0.71	0.71	0.71	0.71
	Mean	0.71	1.53	2.59	1.61a	0.87	1.29	2.16	1.44a
Twice	Zero	0.71	0.71	2.02	1.15	0.71	0.71	2.02	1.15
	52.5	0.71	2.37	3.37	2.15	0.71	2.37	2.72	1.93
	105	0.71	0.71	0.71	0.71	0.71	0.71	1.71	1.04
	157.5	0.71	1.37	4.01	2.03	0.71	1.37	2.68	1.59
	Mean	0.71	1.29	2.53	1.51a	0.71	1.29	2.28	1.43a
Three times	Zero	0.71	1.37	1.37	1.15	0.71	0.71	2.02	1.15
	52.5	0.71	0.71	2.02	1.15	0.71	1.37	2.02	1.37
	105	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	157.5	0.71	2.68	2.68	2.02	0.71	1.37	2.68	1.59
	Mean	0.71	1.37	1.70	1.26a	0.71	1.04	1.86	1.20a
S/K	Zero	0.87	1.70	2.53	1.70a	0.87	1.70	2.45	1.68a
	52.5	0.71	1.53	2.36	1.53a	0.71	1.20	2.24	1.39a
	105	0.87	1.20	2.18	1.42a	0.71	0.87	2.26	1.28a
	157.5	0.71	1.37	2.04	1.37a	0.71	1.04	2.02	1.26a
	Mean	0.79c	1.45b	2.28a		0.75c	1.20b	2.24a	
LSD 5% for:									
Potassium fertilizer (K):					0.59				0.50
Micronutrients (M):					0.53 Ns				0.58 Ns
KM:					1.56				0.72
Storage Methods (S)					0.30				0.29
KS:					Ns				Ns
MS:					Ns				Ns
KMS:					1.24				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 9: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon Sprouting% for onion cultivar Giza 20 inthe two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	0.71	0.71	2.02	1.15	0.71	0.71	2.02	1.15
	52.5	0.71	0.71	0.71	0.71	0.71	0.71	1.37	0.93
	105	0.71	1.37	2.02	1.37	0.71	0.71	2.02	1.15
	157.5	0.71	0.71	2.02	1.15	0.71	2.21	2.87	1.93
	Mean	0.71	0.87	1.70	1.09a	0.71	1.09	2.07	1.29a
Once	Zero	0.71	0.71	3.37	1.60	0.71	0.71	3.37	1.60
	52.5	0.71	0.71	1.37	0.93	0.71	0.71	2.02	1.15
	105	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	157.5	0.71	0.71	1.37	0.93	0.71	0.71	1.37	0.93
	Mean	0.71	0.71	1.70	1.04a	0.71	0.71	1.87	1.10a
Twice	Zero	0.71	0.71	0.71	0.71	0.71	0.71	1.98	1.13
	52.5	0.71	0.71	1.37	0.93	0.71	0.71	1.37	0.93
	105	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	157.5	0.71	0.71	1.37	0.93	0.71	0.71	1.37	0.93
	Mean	0.71	0.71	1.04	0.87a	0.71	0.71	1.36	0.93a
Three times	Zero	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	52.5	0.71	0.71	1.37	0.93	0.71	0.71	1.37	0.93
	105	0.71	0.71	1.37	0.93	0.71	0.71	1.37	0.93
	157.5	0.71	0.71	1.37	0.93	0.71	1.37	1.37	1.15
	Mean	0.71	0.71	1.20	0.82a	0.71	0.87	1.20	0.93a
S/K	Zero	0.71	0.71	1.70	1.04a	0.71	1.25	1.74	1.23a
	52.5	0.71	0.71	1.53	0.98a	0.71	0.71	2.02	1.15a
	105	0.71	0.71	1.20	0.93a	0.71	0.71	1.53	0.98a
	157.5	0.71	0.87	1.20	0.87a	0.71	0.71	1.20	0.87a
	Mean	0.71b	0.751b	1.41a		0.71b	0.84b	1.62a	
LSD 5% for:									
Potassium fertilizer (K):					0.27				0.47
Micronutrients (M):					0.37				0.54
KM:					0.45				Ns
Storage Methods (S)					0.22				0.29
KS:					Ns				Ns
MS:					Ns				Ns
KMS:					0.73				Ns

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

Table 10: Effect of micronutrients, potassium fertilizer, storage methods and their interactionon Sprouting% for onion cultivar Shandaweel 1in the two successive seasons (2011/2012 and 2012/2013)

		First season (2011/2012)				Second season (2012/2013)			
		Storage methods				Storage methods			
Micronutrients	Potassium fertilizer								
(M)	rate (K) kg/feddan	1	2	3	Mean	1	2	3	Mean
Control	Zero	0.71	2.02	2.98	1.91	0.71	0.71	2.72	1.38
	52.5	0.71	1.71	3.25	1.89	0.71	0.71	2.72	1.38
	105	0.71	2.02	4.25	2.33	0.71	1.37	3.03	1.70
	157.5	0.71	3.21	4.95	2.96	0.71	3.71	3.91	2.78
	Mean	0.71	2.24	3.86	2.27a	0.71	1.62	3.09	1.81a
Once	Zero	0.71	1.37	4.57	2.22	0.71	0.71	3.87	1.76
	52.5	0.71	0.71	2.41	1.28	0.71	0.71	2.37	1.26
	105	0.71	0.71	2.72	1.38	0.71	0.71	2.02	1.15
	157.5	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	Mean	0.71	0.87	2.60	1.40b	0.71	0.71	2.24	1.22b
Twice	Zero	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	52.5	0.71	0.71	2.02	1.15	0.71	0.71	2.02	1.15
	105	0.71	0.71	2.37	1.26	0.71	0.71	2.02	1.15
	157.5	0.71	0.71	3.87	1.76	0.71	0.71	3.03	1.48
	Mean	0.71	0.71	2.24	1.22b	0.71	0.71	1.95	1.12b
Three times	Zero	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	52.5	0.71	0.71	3.48	1.63	0.71	0.71	3.21	1.54
	105	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	157.5	0.71	0.71	0.71	0.71	0.71	0.71	1.37	0.93
	Mean	0.71	0.71	1.40	0.94b	0.71	0.71	1.50	0.97b
S/K	Zero	0.71	1.34	2.56	1.54a	0.71	1.46	2.25	1.47a
	52.5	0.71	0.96	2.79	1.49a	0.71	0.71	2.58	1.33a
	105	0.71	1.20	2.24	1.42a	0.71	0.87	1.95	1.18a
	157.5	0.71	1.04	2.51	1.39a	0.71	0.71	2.00	1.14a
	Mean	0.71c	1.13b	2.53a		0.71b	0.94b	2.20a	
LSD 5% for:									
Potassium fertilizer (K):					0.64				0.49
Micronutrients (M):					0.82				0.44
KM:					1.07				0.81
Storage Methods (S)					0.42				0.32
KS:					0.71				0.53
MS:					Ns				Ns
KMS:					1.41				1.06

1= Kraft paper bags

2= Perforated polyethylene bags

3= Plastic nets bags

In Shandaweel 1 cultivar the highest percentage (4.95 and 3.91%) was obtained from Plastic nets bags when k-fertilizer applied at highest rate and three times applying foliar spraying of micronutrients in the first and second seasons, respectively.

In general, our investigation along with previous studies of onion storage reported byPeters *et al*. and Obiadalla-Ali and El-Sawah Nevein, [44, 45] who revealed that, weight loss%, decay% and sprouting% of onions varies according to cultivar. The storage method "Kraft paper bags" was the best methods while "Plastic nets bags" was the worst all over the cultivars. The lowest weight loss%% after six months in the Kraft paper bags was resulted from cultivar Giza 20 (31.44% and 33.26%) in the first and second season, respectively (Table 3). While, The lowest decay%% after six months in the Kraft paper bags was resulted from cultivar Shandaweel 1 (0.79% and 0.75%) in the first and second season, respectively (Table 7), indicating that this cultivar was better weight loss than the other two cultivars. In addition, both Giza 20 and Shandaweel 1 cultivars showed the lowest sprouting% (0.71%) in both seasons (Tables 9 and 10), while Improved Giza 6 cultivar showed the highest sprouting% (0,79% and 0.75%) in the first and second season, respectively (Table 8), indicating that this cultivar was worse sprouting than the other two cultivars. Similar results were reported by Obiadalla-Ali and El-Sawah Nevein, [45] who used storage method Kraft paper bags and showed that Shandaweel 1 cultivar was the least in percentage decay and Giza 20 cultivar was the least percentage of sprouting under the two irrigation systems. Similar findings also reported by Metwally, [43] who found that the bulbs of cultivar Giza 6 was higher percentage of sprouting after 6 months of normal storage, while cultivar Beheiry was lower percentage of sprouting.Similar findings also reported by Gamal, [46], who found that the percentage of weight loss% and decay 5 after 150 days storage was 27.72% and 9.93%., respectively. As well asWarid and Ahmed [47] mentioned that the decrease in weight loss was 5.9, 12.7 and 23.0% after 5, 16 and 30 weeks in storage, respectively.

CONCLUSION

From the above mentioned results it could be concluded that the lowest sprouting%, decay% and weight loss% were obtained from plastic nets bags in all cultivars. The interaction among trace elements application, potassium fertilizer rate and storage methods, had a significant influence sprouting%, weight loss% on Shandaweel 1 cultivar in both seasons and only in the first season, respectively. The interaction among trace elements application, potassium fertilizer rate and storage methods, had no significant influence decay% on all cultivars, in both seasons.

REFERENCES

1. FAO, 2012. Crop county statistics. Available online at www.faostat.org/production /crops. (Accessed on 20-12-2013).
2. Ministry of Agriculture. 2012. The yearly book of Economics and Statistics, Egypt, winter crops section, Onion.
3. Hanen, N., S. Fattouch, E. Annar and M. Neffati, 2006. *Allium* species, ancient health food for the future? In: B. Valdez (ed.). Scientific, Health and Social Aspects of the Food Industry. Europe: In Tech Publisher, pp: 343-354.
4. Karadeniz, F., H.S. Burdurlu, N. Koca and Y. Soyer 2005. Antioxidant activity of selected fruits and vegetables grown in Turkey. Turk. J. Agric. For., 29: 297-303.
5. Jorjandi, M., G.H.S. Bonjar, A. Baghizadeh, G.R.S. Sirchi, H. Massumi, F. Baniasadi, S. Aghighi and P.R. Farokhi, 2009. Biocontrol of Botrytis allii Munn the causal agent of neck rot, the postharvest disease in onion, by use of a new Iranian isolate of Streptomyces. Am. J. Agric. Biol. Sci., 4: 72-78.
6. Fidan, H. and A. Koc, 2001. Dynamic behavior of onion prices in Turkey. Turk. J .Agric. For., 25: 195-200.
7. Abu-Grab, O.S., E.A. El-Kabbany and S.H.H. Kandeel, 1993. Effect of some micronutrients on growth, seed yield, photosynthetic pigments and mineral content of onion. Egypt. J. Appl. Sci., 8(12): 98-105.
8. Ghoname, A., Z.F. Fawzy, A.M. El-Bassiony, G.S. Riadand and M.M.H. Abd El-Baky, 2007. Reducing onion bulbs flaking and increasing bulb yield and quality by potassium and calcium application. Australian Journal of Basic and Applied Sciences, 1(4): 610-618.
9. Shaheen, A.M., F.A. Rizk, E.H. Abd El-Samad and Z.S.A. El-Shal, 2012. Growth, Yield and Chemical Properties of Spinach Plants as Influenced by Nitrogen Fertilizer Forms and Micro-elements Foliar Application. Journal of Applied Sciences Research, 8(2): 777-785.

10. Smriti, S., R. Kumar and S.K. Singh, 2002. Effect of sulphur and boron nutrition on growth, yield and quality of onion (*Allium cepa* L.). Journal of Applied Biology, 12: 40-46.
11. Rabinowitch, H.D. and J.L. Brewster, 1990. Onions and Allied Crops. II. Agronomy, Biotic Interactions, Pathology and Crop Protection. CRC Press Inc. Boca Raton, FL, USA, pp: 320.
12. Kariuki, J.W. and P.M. Kimani, 1994. Yield and storage potential of onion cultivars in Kenya. In Proceedings of the 1st Eastern African Regional *Alliums* Workshop. *(H. D Rabinowitch, P. M. Kimani and R. Peters, ed.),* pp: 50-56. Nairobi, Kenya, 21-22 Sept.
13. Gomez, K.A. and A.A. Gomez, 1984. Statistical procedures for Agriculture Research. 2nd.Ed. John-Willey and Sons, Inc. New York, pp: 680.
14. Jones, H.A. and L.K. Mann, 1963. Onions and their Allies. Leonard Hill Books London, pp: 1-285.
15. Ullah, M.H., S.M.I. Huq, M.D.U. Alam and M.A. Rahman, 2008. Impacts of sulphur levels on yield, storability and economic return of onion. Bangladesh Journal of Agricultural Research, 33(3): 539-548.
16. Tekalign, T., Y. Abdissa and L.M. Pant, 2012. Growth, bulb yield and quality of onion (*Allium cepa* L.) as influenced by nitrogen and phosphorus fertilization on Vertisol. II: Bulb quality and storability. African Journal of Agricultural Research, 7(45): 5980-5985.
17. Currah, L. and H.D. Rabinowitch, 2002. Allium Crop Science: Recent Advances, CABI Publishing, pp: 329-515.
18. Msika, R.L. and J.E. Jackson, 1997. Onion Production and Research in Zimbabwe: Country report. In: *Allium* Crop Science (eds. Rabinowitch, H.D. and Currah, L.). *CABI Publishing*, UK, pp: 241-242.
19. Rubatzky, V.E. and M. Yamagunchi, 1997. World Vegetables: Principles, Production and Nutritive Value 2nd ed. International Thomson Publishing, pp: 804.
20. Babatola, L.A. and O.L. Lawal, 2000. Comparative yield and storability of two tropical onion (*Allium cepa* L.) cultivars under different storage structures. Proceedings of the 18th Hortson Conference, IAR/ABU, Zaria.s
21. Dantata, I.J., 2014. Effect of nitrogen, phosphorus and storage methods on storability of onion in Bauchi, Nigeria. Asian Journal of Applied Sciences, 2(3): 375-380.
22. Ahmed, M.E.M., A. Derbala and N.A. El-Kader, 2009. Effect of irrigation frequency and potassium source on the productivity, quality and storability of garlic. Misr Journal of Agricultural Engineering, 26(3): 1245-1262.
23. Mansour, F.Y.O., 2006. Physiological studies on garlic (*Allium sativum* L.). M.Sc. Thesis, Fac. Agric., Minufiya Univ., Egypt.
24. Kale, L., 2010. Studies on effect of different sources of nitrogen and potassium on productivity and shelf life of onion (*Allium cepa* L.) var. ArkaKalyan. A Thesis submitted to the University of Agricultural Sciences, Dharwad, pp: 27-56.
25. El-Sayed, H.E.A. and A.H.A. El-Morsy, 2012. Response of productivity and storability of garlic (*Allium sativum* L.) to some potassium levels and foliar spray with mepiquat chloride (PIX). International Research Journal of Agriculture and Soil Science, 2(7): 298-305.
26. Hewett, E.W., 2006. An overview of postharvest factors influencing postharvest quality of horticultural products. International Journal of Postharvest Innovation, 1: 4-15.
27. Omran, A.F., M.M. El-sayed, A.A. Midan and M.A. Fathalla, 1984. Growth of Onion plants (*Allium cepa* L.) as affected by foliar spraying of indol acetic acid (IAA) combined with Zn or Mn nutrients. Minufiya J. Agric. Res., 8: 385-405.
28. El-Mansi, A.A.A. and M.S.M. Sharaf El-Dien, 2005. Effect of foliar spray with boron and copper on dry weight, yield and storability of onion under Sandy soil conditions. Zagazig Journal of Agriculture Research, 32(3): 767-691.
29. Adamicki, F. and A.K. Kepka, 1974. Storage of onions in controlled atmospheres. Acta Hort. (ISHS), 38: 53-74.
30. Brewster, J.L., 1994. Onions and other vegetable Alliums. CAB International, Wallingford, U.K, pp: 236.
31. Warid, W.A., J.C. Guerero and J.M. Loaiza, 1996. Storage quality of bulbs of ten cultivars evaluated in Sonora, Mexico. Onion Newsletter for the Tropics, 7: 17-21.
32. Brice, J.L., A.M. Currah, A. Mulins and R. Bancroft, 1997. Onion storage in the tropics: A practical guide to methods of storage and their selection. Chatham, U.K: Natural Resources Institute, pp: 126.

33. Msuya, D.G., S.W.O.M. Reuben, L.B. Mbilinyi, A.P. Maerere, T. Msogoya, L.S. Mulungu and R.N. Misangu, 2005. Evaluation of seed performance and storage of Some Tropical Short Day Onion (*Allium cepa* L.) Cultivars. West African Journal of Applied Ecology, 8: 115-127.
34. Abu, M., J.A. Yidana and F.A. Chimsah, 2006. Onion storage methods used in the Bawku East and West Districts of Ghana. Ghana Journal of Horticulture, 5: 149-156.
35. El-Shafie, F.S. and E. El-Gamaily, 2002. Effect of organic manure, sulphur and microelements on growth, bulb yield, storability and chemical composition of onion plants. Minufiya J. Agric. Res., 27(2): 407-424.
36. Abd El-Mawgoud, A.R., S.R. Abou-Hussein and M.A. El-Nemr, 2005. Interactive effects of zinc and different nitrogen sources on yield and quality of onion. Arab- Universities J. of Agric. Sci., 13(3): 863-875.
37. Abd El-Samad, E.H., R. Kh M. Khalifa, Lashine Z.A. and M.R. Shafeek, 2011. Influence of urea fertilization and foliar application of some micronutrients on growth, yield and bulb quality of onion. Aust. J. Basic Appl. Sci., 5(5): 96-103.
38. Rahim, M.A., A. Hussaini and M.A. Siddique 1983. Production of bulb and storage ability of three onion cultivars. Punjab Vegetable Growers, 117(xviii): 13-20.
39. Pak, C., L.H.W. Van der plas and A.D. De Boer, 1995. Respiration and ethylene evolution of certain fruits and vegetables in response to carbon dioxide in controlled atmosphere storage. Journal of Food Science and Technology, 30: 29-32.
40. Henriksen, K. and S.L. Hansen, 2001. Increasing the dry matter production in bulb onions (Allium cepa L.). Acta Horticulturae, 555: 147-152.
41. Wheeler, T.R., A.J. Daymond, R.H. Ellis, J.I.L. Morison and P Hadley 1998. Postharvest sprouting of onion bulbs grown in different temperature and Carbon dioxide environments in the UK. Journal of Horticultural Science and Biotechnology, 73: 750-754.
42. Vince, A.F., J.R. Carl, B.T. Cindy and A.W. Jerry, 2002. Yellow storage onions (*Allium cepa* L.) vegetable crop management.
43. Metwally, A.K., 2002. Effect of foliar fertilization with microneutrients on yield and storageability of onion (*Allium cepa* L.) and garlic (*Allium Sativum* L.) Plants. The 3rd Scientific Conference of Agricultural Sciences, Assiut. 20-22 October, pp: 245-262.
44. Peters, R.J., T. Kowithayakorn, T. Chalard and H.D. Rabinowitch, 1994. The effect of date of harvest on Shelf Life of Onions Stored by Hanging from Leaves. Acta Hort. (ISHS), 358: 365-368.
45. Obiadalla-Ali, H.A. and El-Sawah Nevein, 2009. Yielding and storability of some onion cultivars grown under two irrigation systems. Minufiya J. Agric. Res., 34(2): 697-718.
46. Gamal, H.A., 1994. Effect of selection and some cultural practices on yield and quality characteristics of onions under Upper Egypt condition. Ph.D. Thesis, Fac. Agric., Assiut Univ.
47. Warid, W.A. and A.A. Ahmed, 1960. Nature of storage losses in the Egyptian varieties of onion. J. Agric. No. 3 and 4 in (Arabic).