Effect of Preharvest Propagation Method, Nitrogen Fertilizer Sources and Soil Addition with Some Growth Stimulants on Storability of Potato Plants Stored under Room Temperature Conditions

Zaki, M. El-S., M. H. M. Mohamed and S. S. Halawa
Hort. Dept., Fac. Agric., Benha Univ., Egypt
Corresponding author: Samar.halawa@fagr.bu.edu.eg

Abstract

Two experiments were carried out during the two successive Summer seasons of 2017and 2018 at Post Harvest Lab. Horticulture Department of Faculty of Agriculture, Benha University, to investigate the effect of two propagation methods (cutting tuber and mini tubers), sources of N fertilizers in either organic and or mineral forms (100% mineral N fertilizer (as recommended dose120 N kg/fed) ; 50% mineral-N + 50% organic-N fertilizers, 25% mineral-N + 75% organic-N fertilizers or 100% organic-N fertilizers) and soil addition with effective microorganisms (EM) at 10%, seaweed extract at 1% and yeast extract at 10% as well as their combinations on storability of potato (*Solanum tuberosum L.*) cv. Spunta. At harvest time, tubers from each experimental plot were collected and stored after discarding the infected tubers. The sound tubers were packed in net package (2kg in weight) and stored under room conditions at Post Harvest Lab. Horticulture Department of Faculty of Agriculture, Benha University. The average of normal room temperature during the two storage seasons of 2017 and 2018. Stored tubers were inspected at every month interval for determining weight loss, decay and chemical analysis. Obtained results showed that, It is evident clearly that planting potato by cutting tubers then fertilized with 100% of the recommended N dose at 120kg/fed as organic form(chicken manure) combined with the soil addition of EM at 10% three times gave the lowest weight loss and decay percentage and the highest dry matter, protein and starch content during storage period (4months) under room storage conditions.

Keywords: Potato, propagation method, organic N fertilizer, growth stimulants, growth, storabilty.

Introduction

Potato (*Solanum tuberosum L.*) is one of the major world food crops. The contribution of potato in world food basket is only after wheat, rice and maize. Potato is an economical food and it provides a source of low-cost energy to the human diet. It is a rich source of starch, vitamin C, B and minerals. It also contains the right amounts of essential amino acids (Paul Khurana and Naik, 2003). According to the recorded data obtained from the Department of Agricultural Economics and Statistics, Ministry of Agriculture and land Reclamation, Egypt, the cultivated area of potato in 2017/2018 reached about 376631 feddans, which yielded 4113441tons of tubers with an average of about12.567 ton/fed. Egypt imports 120602 tons of potato from European union as a seed every year to be cultivated in the summer season. Potato is propagated by three methods, the first method was by tubers called commercial method and mini tubers which produced from true seeds or tissue culture technique (**Djurdjjing et al. 1997).**

Organic manures, particularly chicken manure, have traditionally been used by potato farmers. The use of organic matter to meet the nutrient requirement of crops would be a specific practice in years to come, particularly for resource-poor farmers. Furthermore, ecological and environmental concerns over the increased and indiscriminate use of inorganic fertilizers have made research on the use of organic materials as a source of nutrients essential (**Upadhyaya *et al.*, 2003**). Organic manures, like chicken manure, can play a vital role in potato productivity and storability. These sources can reduce the differences in soil nutrients and improve soil organic matter, humus, and overall soil productivity (**Jenssen, 1993**). Soil organic matter acts as "cement" for water holding clay and soil particles together, thus contributing to the crumb structure of the soil, providing resistance against soil erosion, binds micronutrient metal ions in the soil to check the leach out of surface soils. Moreover, potato plant has high nutrients requirements, especially N- fertilizers, mainly due to its shallow root system and short growth duration (Acland, 1980). Still, its recovery of fertilizer-N is often quite low. Therefore, the liberal application of mineral N-fertilizers to maintain an adequate level of N in the rhizosphere leads to the accumulation of excessive levels of NO_3-N in the plant (Maynard et al. 1976) as well as contribute to high NO_3-N content of groundwater (Viets and Hageman, 1971). A sophisticated combination of organic manures, inorganic fertilizers and bio fertilizers might help obtain high potato productivity and good soil health for sustainability. Therefore, integrated nutrient management (INM) in which organic manures, inorganic fertilizers, and bio fertilizers are used simultaneously has been suggested as the most effective method to maintain a healthy and sustainable soil system as well as increasing crop productivity (**Mondal *et al.*2008**). There is evidence from field research that high and sustainable yields are possible with integrated use of organic fertilizers, inorganic fertilizers and biofertilizers (**Singh *et al.*, 2007**).

The effective microorganism is an organic fertilizer used for soil and foliar application to promote growth and increase yield and is made from

a solution of EM and molasses usually added to bran or straw and then fermented. It has been shown that the application of EM can improve photosynthetic efficiency and capacity due to an increase in nutrient availability, as well as increase root mass **(Lindani and Bvenura 2012)**. Use of the microorganisms as a soil addition, which should improve physical-chemical and biological properties and increase soil organic matter, cation exchange capacity, available mineral nutrients as environment-friendly biofertilizer helps to reduce the use of much expensive phosphatic fertilizers **(Idris *et al.* 2018)**. Worldwide, seaweed-based agricultural products are commonly employed in organic or reduced-input cropping systems. Seaweed extract is known as a source of plant growth regulators **(Herrera *et al.*, 2014)** organic osmolites, amino acids mineral nutrients, vitamins and vitamin precursors. Seaweed extract as a soil conditioning agent combines with metabolic radicals to form cross-link polymers, which increase water-holding characteristics of the rhizosphere contribute to creating an environment more suitable for the growth of roots and root-associated beneficial micro-organisms **(Sutharsan *et al.*, 2014)**.

Yeast extract was suggested to share a beneficial role during the vegetative and reproductive growth stage through improving flower formation and their set of some plants due to its high auxin and cytokinin contents and enhancement of carbohydrate accumulation **(Barnett et al., 1990)**. Also, it has stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis, and chlorophyll formation **Malash *et al.* (2014)**. Besides, Application of yeast as soil addition significantly increased plant growth and yield of potato plants (**Doklega (2017)**

Therefore, the present study was an attempt to improve an storability of potato tubers during the early summer season by using two propagation methods (cutting, mini tuber) organic and mineral nitrogen fertilization and soil addition with some growth stimulants such as yeast extract, seaweed extract, and EM

Materials and Methods

Two field experiments were carried out during the two successive Summer seasons of 2017and 2018 at the farm of the Faculty of Agriculture, Moshtohor, Benha University to investigate the effect of propagation methods, sources of N fertilizers in either organic and or mineral forms and soil addition with effective microorganisms (EM), seaweed extract and yeast extract s well as their combinations on storability of potato (*Solanum tuberosum* L.) cv. Spunta. Potato tubers were planted on 2nd January in the first and second seasons, respectively. This investigation was set up in a split-plot design with three replicates in both seasons of study. Each experimental plot included four rows of 4m in length and 80 cm in width, with an area of 12.8 m^2. Potato tubers were planted 30 cm apart on one side of ridges. Cultural management, disease, and pest control programs were followed according to the recommendation of the Egyptian Ministry of Agriculture.

Each experiment included 24 treatments resulted from the combination of two propagation methods with four nitrogen fertilizer treatments and three soil addition treatments as follows.

a. propagation methods:

1- Cutting tubers: - every piece weight 40-50 g and have 2-3 eyes

2- Mini tubers: - every piece weigh 20-25 g and have 2-3eyes.

b. Nitrogen fertilizer sources:

1. 100% mineral N fertilizer (as recommended dose120kg/fed)
2. 50% mineral-N fertilizers + 50% organic-N fertilizers
3. 25% mineral-N fertilizers + 75% organic-N fertilizers
4. 100% organic-N fertilizers

Either in mineral form as ammonium nitrate [NH_4NO_3, 33%] or in organic form as chicken manure. Nitrogen sources were used at a rate of 120kg N/fed as recommended by the Ministry of Agriculture.

The amounts of organic fertilizer (chicken manure) were added during soil preparation. Meanwhile, the mineral-N fertilizers were divided into three equal portions and were added after three weeks from planting, and every two weeks by the interval.

c. Soil addition treatments:

1. Effective microorganisms (EM) at 10%.
2. Yeast extract at 10%.
3. Seaweed extract at 1%.

The soil addition treatments with EM, yeast, and seaweed extract were added three times started after 21 days from planting and every 15 days intervals. In this experiment, a split split-plot design with three replicates was adopted where propagation methods were randomly distributed in the main plots, while nitrogen fertilizer treatments were randomly distributed in the subplots, while the soil addition treatments were randomly distributed in the sub-sub plots. All other Agricultural practices required for potato production were carried out according to the recommendations of the Ministry of Agriculture.

Storability

At harvest time, tubers from each experimental plot were collected and stored after discarding the infected tubers. The sound tubers were packed in plastic net package (2kg in weight) and stored under room conditions at Post Harvest Lab. Horticulture Department of Faculty of Agriculture, Benha University. Each replicate was consisted of3 packages that make 6kg in weight. One package (2kg) was taken

for measuring weight loss and the other 2 packages (4kg) were taken for determining decay percentage and chemical analysis during the storage periods. Stored tubers were inspected at one month interval for determining weight loss, decay and chemical analysis and the following data were recorded.

a. Total weight loss percentage: It was estimated according to the following equation.

$$\textbf{Weight loss percentage} = \frac{\text{initial weight - weight at each inspection interval}}{\text{initial weight}} \times 100$$

b. Decay percentage: Decayed tubers were counted and recorded by visual examination which included all the shrinked, injured or spoiled ones resulting from microorganisms infection and had been calculated in relation to total initial weight of stored tubers (**Cheour *et al*, 1990**).

c. Crude Protein%: it was determined according to **Pregl (1945)** using the micro-kyeldahl apparatus. A factor of 6.25 was used for conversion of total nitrogen to protein percentage.

d. Starch content: It was determined as described in **A.O.A.C. (1990).**

e. dry matter.

6. Statistical analysis :

All collected data in both seasons of the study were subjected to statistical analysis of variance as factorial experiments in split split-plot design, according to **Sndecor and Cochran (1991)**, where the least significant difference was considered when even possible.

Results and discussion

Storability of tubers of potato can be judged through many aspects among them are weight loss as well as decay percentage and chemical constituents such as changes in (protein -starch-dry matter percentage)

1. Weight loss percentage: -

With regard to the effect of propagation methods on weight loss percentage of potato tubers during storage periods, such data (Table 1) indicate that there were significant differences among the studied propagation methods in total weight loss of tubers during storage. In this respect, the lowest weight loss was recorded in case of using cutting tubers in both seasons at the end of storage period (4 months) at room temperature storage.

As regards to the effect of storage periods, results show that prolonging storage periods up to 4 months gradually and significantly increased weight loss percentages. As average of both seasons, during the first month stored tubers which were previously produced from cutting tubers or mini tubers lost 3.14% or 3.45%, respectively. Such weight loss was continuously increased reaching 13.05% and 14.75%, respectively. after four months of storage. (**Mareček *et al* (2009)**, **Park *et al* (2009)** , and **Hossain *et al* (2017)**

As for the Effect of nitrogen fertilizer sources on weight loss percentage of potato tubers during storage periods, such data indicate that there were significant differences among the studied nitrogen fertilization sources in total weight loss% of tubers of potato during the storage .In this respect, the lowest weight loss percentage was recorded in case of using 100% organic nitrogen. As average of both seasons, during the first month stored tubers lost 3.04% and reached 12.97% after four months. followed by using (25% mineral plus 75% organic nitrogen) and by using (50% mineral nitrogen plus 50% organic nitrogen) and the highest weight loss was found by using 100% mineral nitrogen, as average of both seasons, during the first month stored tubers lost 3.53% and reached 14.74% after four months. Such increases in weight loss percentage with increasing the percentage of mineral nitrogen in applied fertilizer may be attributed to the increase in moisture content and the decrease of dry matter in tubers due to nitrogen application. In this respect, **Elbauome(2005)**, **Wojdyla *et al* (2009)**, **Kumar *et al* (2011)** reported that increasing mineral nitrogen fertilizer level increased weight loss percentage of potato tubers during storage. With regard to the effect of soil addition treatments on weight loss percentage of potato tubers during storage periods**,** data recorded in table (1) indicate that soil addition with EM at10%, yeast extract at10% and seaweed extracts at 1% significantly affected the percentage of weight loss in potato tubers during the both seasons of study. The lowest weight loss was recorded in case of using EM at 10%.followed by seaweed extract and yeast extract as average of both seasons. As regards to the effect of interaction between soil addition and period storage results show that the lowest weight was detected to tubers treated with using EM (10%), as average of both seasons, whereby during the first month stored tubers lost 3.10% and reached 13.18% after four months.as compared with the other used material i.e. yeast or seaweed extract. Such decreases in weight loss percentage with soil addition treatments may be attributed to the role of such natural growth stimulant substances in decreasing the susceptibility for diseases infection, the respiration rate and production of ethylene which affects greatly tubers storage ability. (**Kolodziejczyk (2016)**

Table 1. Effect of propagation methods, nitrogen fertilizer sources and soil addition treatments as well as their interaction on weight loss % of potato tubers stored at room temperature during the two seasons of study 2017 and 2018.

Treatments			First Season2017(months)					Second Season2018(months)				
Propagation Methods	Nitrogen fertilization	Soil Addition	1	2	3	4	Mean	1	2	3	4	mean
Cutting tubers			3.22	6.95	9.92	15.97	9.02	3.05	5.07	7.49	10.13	6.43
Mini tubers			3.58	8.12	11.44	17.95	10.27	3.32	5.36	8.28	11.55	7.13
L.S.D.				0.36		0.13			0.31		0.59	
	100% mineral N		3.71	7.98	11.61	17.95	10.32	3.34	5.40	8.40	11.53	7.17
	50% mineral + 50% organic N		3.51	7.72	11.18	17.34	9.93	3.25	5.32	8.10	11.62	7.07
	25% mineral + 75% organic N		3.28	7.33	10.17	16.57	9.33	3.16	5.19	7.68	10.24	6.57
	100% organic N		3.09	7.11	9.75	15.99	8.99	2.99	4.95	7.36	9.95	6.31
	L.S.D.			0.51		0.33			0.45		0.22	
		EM	3.22	6.70	9.69	16.33	8.99	2.98	4.90	7.42	10.04	6.33
		Yeast extract	3.63	8.84	11.67	17.70	10.46	3.33	5.59	8.44	11.76	7.28
		Seaweed extract	3.35	7.06	10.67	16.85	9.48	3.25	5.17	7.80	10.71	6.73
		L.S.D.		0.44		0.22			0.39		0.195	
		EM	3.24	6.47	9.38	16.77	8.96	2.86	4.90	7.22	9.38	6.09
	100% mineral N	Yeast extract	3.70	8.69	12.57	17.93	10.72	3.03	5.85	9.15	12.55	7.64
		Seaweed extract	3.46	7.09	10.86	16.68	9.52	3.45	5.01	7.54	10.15	6.53
		EM	3.15	6.2	8.85	15.64	8.46	3.01	4.88	7.29	9.78	6.24
	50% mineral + 50% organic N	Yeast extract	3.49	8.32	11.26	17.26	10.08	3.17	5.55	7.85	11.87	7.11
		Seaweed extract	3.28	6.67	10.18	16.31	9.11	3.15	5.28	7.39	9.93	6.43
Cutting tubers		EM	3.02	6.00	8.17	14.78	7.99	2.95	4.72	7.13	9.13	5.98
	25% mineral + 75% organic N	Yeast extract	3.27	8.04	10.59	16.55	9.61	3.18	5.42	7.74	10.45	6.69
		Seaweed extract	3.13	6.28	9.66	15.36	8.60	3.11	5.11	7.22	9.70	6.28
		EM	2.91	5.88	7.97	13.7	7.61	2.80	4.47	6.59	9.27	5.78
	100% organic N	Yeast extract	3.02	7.79	10.09	15.87	9.19	3.01	5.05	7.65	9.87	6.39
		Seaweed extract	2.98	6.06	9.47	14.82	8.33	2.94	4.71	7.14	9.42	6.05
		EM	3.73	7.58	11.27	18.33	10.23	3.17	5.12	7.95	10.87	6.77
	100% mineral N	Yeast extract	4.23	9.93	13.66	19.21	11.76	3.80	6.05	9.55	14.03	8.35
		Seaweed extract	3.95	8.12	11.94	18.79	10.7	3.72	5.49	9.04	12.21	7.61
		EM	3.5	7.49	11.79	17.73	10.13	3.11	5.04	8.42	12.08	7.16
	50% mineral + 50% organic N	Yeast extract	4.00	9.76	12.87	18.89	11.38	3.65	5.73	9.08	13.08	7.88
		Seaweed extract	3.65	7.9	12.13	18.18	10.47	3.45	5.48	8.57	12.95	7.61
Mini tubers		EM	3.19	7.13	10.29	16.91	9.38	3.05	5.07	7.53	10.28	6.48
	25% mineral + 75% organic N	Yeast extract	3.82	9.243	11.48	18.26	10.70	3.49	5.60	8.37	11.02	7.12
		Seaweed extract	3.26	7.33	10.83	17.54	9.74	3.23	5.27	8.12	10.87	6.87
		EM	3.03	6.92	9.86	16.81	9.15	2.95	4.99	7.25	9.54	6.18
	100% organic N	Yeast extract	3.51	9.00	10.82	17.63	10.24	3.32	5.48	8.18	11.22	7.05
		Seaweed extract	3.12	7.05	10.31	17.13	9.40	2.95	5.04	7.38	10.41	6.44
	L.S.D.			1.26		0.63			1.10		0.55	

Data in Tables (1) show clearly that the weight loss percentage of tubers was steadily and constantly increased with prolonging the storage period. In this regard, the lowest weight loss percentage was noticed during the first month whereby stored tubers lost 3.4 and 3.19% at the first and second seasons, respectively. On the contrary, the highest weight loss percentage was noticed after four months (16.96% and 10.84%) during first and second season. Similar results were recorded in the two seasons of study. Obtained results may be due to the loss of water and degradation and use of complex molecules in respiration, which affect flashness of tubers and make it to be susceptible for infection and more perishable.

As for the effect of interaction, data in table (1) indicate that there were significant effects in tuber weight loss percentages as result of the interaction between the propagation methods , soil addition and nitrogen fertilizer sources within the different periods during the storage period .In this regard, the lowest values of weight loss percentage were recorded in case of using pre harvest cutting tubers with nitrogen fertilizer only in 100% organic sources and using EM(10%) as soli addition, as average of both seasons, during the first month stored tubers lost 2.85% and reached 11.48% after four months. On the contrary, the using of mini tubers that were fertilized only with 100% mineral nitrogen with the addition of yeast extract at10% three times. reflected the highest weight loss percentage, as average of both seasons. During the first month stored tubers lost 4.015% and reached 16.62% after four months of storage.

2. Decay percentage:-

As for the Effect of propagation methods on decay percentage of potato tubers during storage periods, data in (table 2) indicate that there were significant differences among the studied propagation methods in total decay percentages of potato tubers during storage. In this respect, the lowest decay was recorded in case of using cutting tubers at the end of storage period (4 mouths) at room temperature storage. As regards to the effect of storage periods, results show that prolonging of storage periods up to 4 months gradually and significantly increased decay percentages. As average of both seasons, during the first month stored tubers that were previously produced from cutting tubers and mini tubers lost 1.71% and 4.69%, respectively. Such decay was continuously increased reaching 13.59% and 16.96% after four months of storage, respectively. (**Park *et al,* 2009** ; **Hossain *et al* , 2017**

With regard to the effect of nitrogen fertilizer sources on decay percentage in potato tubers during storage periods, such data indicate that there were significant differences among the studied nitrogen fertilization sources in total decay of tubers of potato during the storage. as average of both seasons, the lowest decay percentage was recorded in case of using 100% organic nitrogen, whereby during the first month stored tubers lost 1.62% and reached 13.94% after four months followed by using (25% mineral plus 75% organic nitrogen) and by using (50% mineral nitrogen plus 50% organic nitrogen)and finally by using 100% mineral nitrogen. (**Elbauome,2005; Kumar *et al,* 2011; El-Metwally 2012; Ibrahim ,2015)**.

As for the Effect of soil addition treatments on decay percentage of potato tubers during storage periods, data recorded in table (2) show that. The lowest decay% was recorded in case of using seaweed extract (10%) followed by EM and yeast extract as average of both seasons. As regards to the effect of interaction between soil addition and storage period results show that the lowest decay was detected by tubers treated with using seaweed extract (10%), As average of both seasons, during the first month stored lost 1.64 and reached 12.92 % after four months. As for the effect of the interaction on decay percentage of potato tubers, data in table (2) indicate that there were significant effects on tuber decay percentages as result of the interaction between the propagation methods , soil addition and nitrogen fertilization treatments within the different periods of the storage .In this regard, the lowest value of decay percentage was recorded in case of using pre harvest cutting tubers with nitrogen fertilizer only as 100% organic source and using seaweed extracts(10%) as soil addition . As average of both seasons, during the first month stored tubers lost 1.17% and reached 9.51% after four months. .On the contrary , the using of pre harvest mini tubers and Fertilized only with 50% mineral plus 50% organic nitrogen and the addition of yeast extract reflected the highest decay percentage. As average of both seasons, during the first month stored tubers lost 3.32% and reached 21.45% after four months.(**Kolodziejczyk (2016)**).

Table 2. Effect of propagation methods, nitrogen fertilizer sources and soil addition treatments as well as their interaction on decay% of potato tubers stored at room temperature during the two seasons of study 2017 and 2018.

Treatments			First Season2017(months)					Second Season2018(months)				
Propagation Methods	**Nitrogen fertilization**	**Soil Addition**	**1**	**2**	**3**	**4**	**Mean**	**1**	**2**	**3**	**4**	**mean**
Cutting tubers			**2.95**	**5.95**	**8.43**	**15.64**	**8.24**	**0.45**	**0.81**	**4.11**	**11.54**	4.23
Mini tubers			**4.22**	**7.91**	**10.90**	**20.27**	**10.83**	**0.47**	**0.92**	**5.83**	**13.66**	5.22
L.S.D.				**0.66**		**0.81**			**0.37**		**0.23**	
	100% mineral N		**3.90**	**7.57**	**10.23**	**18.87**	10.15	**0.81**	**1.30**	**6.40**	**14.03**	5.63
	50% mineral + 50% organic N		**3.75**	**7.14**	**9.83**	**18.36**	9.77	**0.57**	**1.08**	**5.23**	**13.10**	4.99
	25% mineral + 75% organic N		**3.45**	**6.72**	**9.31**	**17.63**	9.27	**0.47**	**0.76**	**4.43**	**12.33**	4.50
	100% organic N		**3.24**	**6.28**	**9.28**	**16.97**	8.94	**0.00**	**0.30**	**3.82**	**10.92**	3.76
	L.S.D.			**0.93**		**0.49**			**0.52**		**0.26**	
		EM	3.53	6.90	9.43	17.12	9.248	**0.54**	**0.68**	**4.49**	**11.61**	4.33
		Yeast extract	**3.94**	**7.74**	**11.25**	**20.43**	10.84	**0.85**	**1.52**	**7.04**	**16.65**	6.51
		Seaweed extract	**3.28**	**6.14**	**8.32**	**16.32**	8.518	**0**	**0.38**	**3.38**	**9.53**	3.32
		L.S.D.		**0.81**		**0.40**			**0.45**		**0.22**	
		EM	**3.28**	**6.82**	**8.92**	**15.68**	8.67	**0.75**	**1.17**	**4.81**	**11.27**	4.50
	100% mineral N	**Yeast extract**	**3.49**	**7.25**	**11.2**	**20.31**	10.56	**1.51**	**2.08**	**8.42**	**17.53**	7.38
		Seaweed extract	**2.99**	**5.79**	**8.36**	**14.08**	7.80	**0.00**	**0.49**	**2.32**	**9.92**	3.18
		EM	**3.09**	**6.25**	**8.20**	**15.12**	8.16	**0.61**	**0.77**	**3.65**	**11.42**	4.11
	50% mineral + 50% organic N	**Yeast extract**	**3.25**	**6.85**	**9.64**	**19.69**	9.85	**1.02**	**1.32**	**6.90**	**15.87**	6.27
Cutting tubers		**Seaweed extract**	**2.85**	**5.48**	**7.91**	**13.50**	7.43	**0.00**	**1.09**	**2.83**	**8.68**	3.15
		EM	**2.92**	**5.88**	**7.86**	**13.21**	7.46	**0.63**	**0.68**	**3.06**	**10.59**	3.74
	25% mineral + 75% organic N	**Yeast extract**	**3.00**	**6.17**	**9.25**	**19.84**	9.56	**0.97**	**1.28**	**5.47**	**14.21**	5.48
		Seaweed extract	**2.45**	**5.04**	**7.06**	**12.62**	6.79	**0.00**	**0.00**	**2.25**	**8.17**	2.60
		EM	**2.78**	**5.13**	**7.11**	**12.79**	6.95	**0.00**	**0.00**	**3.00**	**10.08**	3.26
	100% organic N	**Yeast extract**	**2.96**	**5.92**	**8.9**	**18.6**	9.09	**0.00**	**0.85**	**4.89**	**13.92**	4.91
		Seaweed extract	**2.35**	**4.88**	**6.82**	**12.22**	6.57	**0.00**	**0.00**	**1.73**	**6.80**	2.13
		EM	**4.41**	**8.23**	**10.32**	**20.86**	10.96	**1.00**	**1.33**	**6.75**	**13.11**	5.54
	100% mineral N	**Yeast extract**	**5.05**	**9.55**	**12.67**	**22.18**	12.36	**1.60**	**2.41**	**11.14**	**20.63**	8.94
		Seaweed extract	**4.22**	**7.83**	**9.93**	**20.10**	10.52	**0.00**	**0.33**	**5.01**	**11.72**	4.26
		EM	**4.25**	**8.00**	**11.85**	**20.21**	11.08	**0.89**	**0.83**	**5.34**	**12.61**	4.91
	50% mineral + 50% organic N	**Yeast extract**	**4.99**	**9.08**	**12.06**	**21.74**	11.97	**0.90**	**1.73**	**7.76**	**19.18**	7.39
		Seaweed extract	**4.09**	**7.19**	**9.34**	**19.88**	10.13	**0.00**	**0.75**	**4.92**	**10.86**	4.13
Mini tubers		**EM**	**3.96**	**7.69**	**11.01**	**19.86**	10.63	**0.43**	**0.73**	**5.17**	**12.04**	4.59
	25% mineral + 75% organic N	**Yeast extract**	**4.61**	**8.84**	**11.77**	**20.93**	11.54	**0.82**	**1.50**	**6.45**	**18.69**	6.86
		Seaweed extract	**3.78**	**6.72**	**8.91**	**19.33**	9.68	**0.00**	**0.42**	**4.21**	**10.29**	3.73
		EM	**3.57**	**7.27**	**10.17**	**19.24**	10.06	**0.00**	**0.00**	**4.16**	**11.79**	3.98
	100% organic N	**Yeast extract**	**4.23**	**8.30**	**14.49**	**20.14**	11.79	**0.00**	**1.00**	**5.33**	**13.14**	4.86
		Seaweed extract	**3.56**	**6.23**	**8.23**	**18.82**	9.21	**0.00**	**0.00**	**3.82**	**9.82**	3.41
	L.S.D.			**2.30**		**1.15**			**1.29**		**0.64**	

Such decreases in decay percentage with soil addition treatments may be attributed to the role of such natural anti disease substances in decreasing the susceptibility for diseases infection, the respiration rate and the production of ethylene which affects greatly tubers storage ability.

With regard to the effect of storage period on decay percentage of potato tubers, data in Tables (2) show clearly that the decay percentage of tuber was steadily and constantly increased with prolonging the storage period. In this regard, the lowest decay percentage was noticed after the first month (3.58% and 0.46%) during the first and second seasons respectively. On the contrary, the highest decay percentage was noticed after four month (17.95% and 12.60%) during the first and second seasons, respectively. Similar results were recorded in the two seasons of study. Obtained results may be due to the increase loss of water and use of complex molecules in respiration, which affect flashness of tubers and make it to be susceptible for infection and more perishable.(**Kolodziejczyk ,2016)**

3. Dry matter percentage

Effect of propagation methods treatment on dry matter of potato tubers during storage periods, such data Table (3) indicate that there are no significant differences among the studied propagation methods in dry matter percentage of potato tubers during storage. **Mareček *et al* (2009)**

As for Effect of nitrogen fertilizer sources on dry matter percentage of potato tubers during storage periods, such data in table (3) show significant effects of pre harvest nitrogen fertilization treatments on changes in chemical constituents of tubers of potato during storage at room temperature. Comparatively the highest dry matter percentage was recorded in case of using only 100% of N fertilizers in organic form. As average of both seasons and during the first month stored tubers possessed 23.21% but it reached 18.25% after four months followed by using 25% in mineral plus 75% in organic nitrogen, but when using 100% only in mineral nitrogen decreased sharply dry matter percentage and as average of both seasons, during the first month stored tubers contained19.45% and reached 18.25% after four months. **Elmehrat *et al* (2013)**, **Ibrahim (2015)**.

With regard Effect of soil addition treatment on dry matter of potato tubers during storage periods, data recorded in table (3) show that soil addition with EM (10%), yeast extract (10%) or seaweed extracts (1%) significantly affected the dry matter percentage of potato tubers during both seasons of study. Such results indicated also that comparatively the highest dry matter percentage was recorded in case of using EM (10%) as average of both seasons, during the first month stored tubers induced 22.06% and reached 20.06% after four months followed by yeast extract and seaweed extracts. **Kolodziejczyk (2016)**

Effect of storage period on dry matter percentage of potato tubers, data in Tables (3) show clearly that the dry matter percentage of tubers was steadily and constantly decreased with prolonging the storage period. In this regard, the highest dry matter percentage was noticed during the first months as (20.9% and 21.8%) of first and second. season respectively. On the contrary, the lowest dry matter percentage was noticed after four months (19.13% and 19.68%) during first and second season. Similar results were recorded in the two seasons of study.

As for Effect of the interaction on dry matter of potato tubers , data presented in table (3) indicate that there were significant effects in studied tubers dry matter percentage due it the use of both propagation materials (cutting or mini tuber), various nitrogen fertilizer sources and three of soil addition substances through four months storage period at room temperature. In this regard, on obvious decreasing tendency in studied dry matter percentage could be recorded with the prolong storage period up to four months at room temperature .Moreover, the highest values of dry matter percentage was observed in case of using potato tubers previously produced from cutting tubers and plants were fertilized with only 100% in organic form and the used soil was amended with EM (10%) as soil addition especially as average of the second seasons.

4- Starch percentage

Such data table (4) indicate that there are significant differences among the studied propagation methods in starch percentage of tubers potato during storage. In this respect, using cutting tuber was recorded the highest values of starch % during both seasons at room temperature storage. As regards to the effect of storage periods, results show that prolong storage periods up to 4 months gradually and significantly decreased starch percentages.as average of both seasons, during the first month of stored tubers that were previously produced from cutting tubers and mini tubers detected 15.43% and 15.09 %, respectively. Such starch% was continuously decreased reaching 14.09% and 13.65% after four months of storage, respectively. **Sharma *et al* (2012)**.

As for **Effect** of nitrogen fertilizer sources on starch percentage of potato tubers during storage periods, such data in Table (4) show a significant effect of pre harvest nitrogen fertilization treatments on changes in chemical constituents of tubers of potato during storage at room temperature comparatively the highest starch percentage was recorded in case of as 100% organic nitrogen, as average of both seasons, during the first month stored 16.77% and reached 15.43% after four months, but using 100% organic nitrogen decreased nitrogen percentage. As average of both seasons, during the first month stored 13.18% and reached 11.71% after four months. **Elbauome(2005). Ibrahim (2015)**,

With regard the Effect of soil addition treatments on starch percentage of potato tubers during storage periods, data recorded in Table (4) show that soil addition with EM(10%) , yeast extract (10%) or seaweed extracts (1%) significantly affected the starch percentage of potato tubers during both seasons of study . Such results indicate also that comparatively the highest starch percentages was recorded in case of using EM(10%) as average of both seasons, during the first month stored 15.8% and reached 14.39% after four months followed by seaweed extract and yeast extract as average of both seasons, during the first month stored 14.73% and reached 13.43% after four months(**Kolodziejczyk, 2016)**.

Effect of storage period on starch percentage of potato tubers, data in Tables (4) show clearly that the starch percentage of tubers was steadily and constantly decreased with prolonging the storage period. In this regard, the highest starch percentage was noticed during the first months stored (15.60% and 14.92%) of first and second season respectively. On the contrary, the lowest starch percentage was noticed after four months (14.19% and 13.55%) during first and second season. Similar results were recorded in the two seasons of study.

As for the effect of the interaction treatments on starch percentage of potato tubers, data presented in Table (4) indicate that there were significant effects in starch percentage due it the use of both propagation materials (cutting or mini tuber) ,various nitrogen fertilizer sources and three of soil addition substances through four months storage period at room temperature. In this regard, on obvious decreasing tendency in studied starch percentage could be recorded with the prolong storage period up to four months at room temperature .Moreover , the highest values of starch percentage was observed in case of using potato tubers previously produced from cutting tubers and plants were fertilized with 100% nitrogen organic form and the used soil was amended with EM (10%) as soil addition as average of both seasons. On the contrary using pre harvest mini tuber and fertilized with 100% in mineral nitrogen form and yeast extract as soil addition recorded the lowest starch % at the end storage period.

5. protein percentage

Such data Table (5) indicate that there are significant differences among the studied propagation methods in protein percentage of tubers potato during storage. In this respect, using cutting tuber was recorded the highest values of protein% during both seasons at the end of storage period (4 months) at room temperature storage. As regards to the effect of storage periods, results show that prolong storage periods up to 4 months gradually and significantly decreased protein percentages.as average of both seasons, during the first month . Stored tubers that were previously produced from cutting tubers and mini tubers detected 11.99% and 11.12 % respectively. Such protein% was continuously decreased reaching 8.40% and 6.62 % after four months of storage, respectively. **Hossain *et al* (2017)**

As for the effect of nitrogen fertilizer sources on protein percentage of potato tubers during storage periods**,** such data in Table (5) show a significant effect of pre harvest nitrogen fertilization treatments on changes in chemical constituents of tubers of potato during storage at room temperature comparatively the highest protein percentage was recorded in case of as 50% mineral nitrogen plus 50% organic nitrogen , as average of both seasons, during the first month stored 12.79 % and reached 8.94% after four months, but using 100% organic nitrogen decreased protein percentage. as average of both seasons, during the first month stored 10.66% and reached 5.94% after four months, **El-Metwally(2012) , Elmehrat *et al* (2013)** and **Ibrahim (2015)**.

Table 3. Effect of propagation methods, nitrogen fertilizer sources and soil addition treatments as well as their interaction on dry matter% of potato tubers stored at room temperature during the two seasons of study 2017 and 2018.

Treatments			First Season2017(months)					Second Season2018(months)				
Propagation Methods	Nitrogen fertilization	Soil Addition	1	2	3	4	Mean	1	2	3	4	mean
Cutting tubers			**20.61**	**20.73**	**20.15**	**19.30**	20.20	**21.84**	**21.42**	**20.76**	**19.82**	20.96
Mini tubers			**21.19**	**20.80**	**20.42**	**18.96**	20.34	**21.76**	**21.42**	**20.88**	**19.54**	20.9
L.S.D.				**0.66**		**0.60**		**0.47**			**0.51**	
	100% mineral N		**18.64**	**18.33**	**18.43**	**18.68**	18.52	**20.06**	**19.64**	**19.19**	**19.21**	19.52
	50% mineral + 50% organic N		**19.81**	**20.38**	**19.63**	**19.68**	19.88	**21.28**	**20.92**	**20.20**	**20.18**	20.65
	25% mineral + 75% organic N		**22.11**	**21.69**	**21.03**	**20.22**	21.26	**22.48**	**22.09**	**21.37**	**20.76**	21.68
	100% organic N		**23.04**	**22.65**	**22.05**	**17.93**	21.42	**23.38**	**23.03**	**22.52**	**18.57**	21.87
	L.S.D.			**0.93**		**0.49**		**0.67**			**0.33**	
		EM	21.79	21.29	20.68	19.79	20.89	**22.34**	**21.94**	**21.23**	**20.34**	21.46
		Yeast extract	**20.60**	**20.15**	**19.92**	**18.43**	19.77	**21.30**	**20.84**	**20.34**	**18.96**	20.36
		Seaweed extract	**20.31**	**20.85**	**20.26**	**19.15**	20.14	**21.76**	**21.48**	**20.89**	**19.74**	20.97
		L.S.D.		**0.81**		**0.40**		**0.58**			**0.29**	
		EM	**19.68**	**19.22**	**18.92**	**1919**	19.25	**20.35**	**19.88**	**19.13**	**20.51**	19.97
	100% mineral N	**Yeast extract**	**17.89**	**17.59**	**17.42**	**18.39**	17.82	**19.92**	**19.08**	**18.69**	**18.73**	19.1
		Seaweed extract	**18.75**	**18.49**	**18.30**	**18.66**	18.55	**20.04**	**19.69**	**18.89**	**19.31**	19.48
		EM	**21.42**	**20.59**	**19.82**	**20.75**	20.65	**21.79**	**22.03**	**20.79**	**21.43**	21.51
	50% mineral + 50% organic N	**Yeast extract**	**20.08**	**19.57**	**19.17**	**19.36**	19.55	**20.42**	**19.80**	**19.32**	**19.26**	19.7
		Seaweed extract	**14.71**	**20.89**	**19.67**	**19.63**	18.72	**21.82**	**21.30**	**20.74**	**20.65**	21.13
Cutting tubers		**EM**	**22.55**	**21.87**	**21.22**	**21.69**	21.83	**22.93**	**22.39**	**21.90**	**21.51**	22.18
	25% mineral + 75% organic N	**Yeast extract**	**21.45**	**21.02**	**20.67**	**19.31**	20.61	**21.89**	**21.42**	**20.82**	**20.01**	21.04
		Seaweed extract	**21.70**	**21.47**	**20.47**	**20.18**	20.95	**22.32**	**21.98**	**20.86**	**21.10**	21.56
		EM	**23.27**	**22.87**	**22.32**	**18.71**	21.79	**23.81**	**23.27**	**22.87**	**18.96**	22.23
	100% organic N	**Yeast extract**	**22.86**	**22.37**	**21.43**	**17.37**	21.01	**23.09**	**22.88**	**22.88**	**17.78**	21.51
		Seaweed extract	**23.00**	**22.86**	**22.37**	**18.30**	21.63	**23.65**	**23.29**	**22.85**	**18.56**	22.09
		EM	**19.53**	**19.29**	**19.12**	**19.00**	19.24	**20.88**	**20.17**	**19.75**	**19.31**	20.03
	100% mineral N	**Yeast extract**	**17.69**	**17.22**	**18.70**	**18.23**	17.96	**19.72**	**19.34**	**18.92**	**18.43**	19.1
		Seaweed extract	**18.29**	**18.20**	**18.10**	**18.58**	18.29	**19.43**	**19.68**	**19.76**	**18.96**	19.45
		EM	**21.65**	**21.09**	**20.05**	**19.50**	20.57	**22.29**	**21.82**	**20.53**	**20.09**	21.18
	50% mineral + 50% organic N	**Yeast extract**	**20.17**	**19.72**	**19.26**	**19.03**	19.55	**20.49**	**20.02**	**19.81**	**19.53**	19.96
		Seaweed extract	**20.86**	**20.43**	**19.79**	**19.83**	20.23	**20.88**	**20.56**	**20.02**	**20.13**	20.4
Mini tubers		**EM**	**22.85**	**22.38**	**21.62**	**21.15**	22.00	**23.12**	**22.81**	**22.12**	**21.83**	22.47
	25% mineral + 75% organic N	**Yeast extract**	**21.88**	**21.41**	**20.95**	**19.06**	20.83	**21.95**	**21.60**	**20.92**	**19.73**	21.05
		Seaweed extract	**22.25**	**22.00**	**21.28**	**19.91**	21.36	**22.69**	**22.32**	**21.60**	**20.39**	21.75
		EM	**23.37**	**23.02**	**22.39**	**18.33**	21.78	**23.52**	**23.18**	**22.78**	**19.09**	22.14
	100% organic N	**Yeast extract**	**22.79**	**22.31**	**21.73**	**16.69**	20.88	**22.92**	**22.56**	**21.93**	**18.20**	21.4
		Seaweed extract	**22.95**	**22.49**	**22.08**	**18.14**	21.42	**23.29**	**23.00**	**22.39**	**18.84**	21.88
	L.S.D.			**1.28**		**1.14**		**1.65**			**0.82**	

Table 4. Effect of propagation methods, nitrogen fertilizers and soil addition treatments as well as their interaction on starch percentage of potato tubers stored at room temperature during the two seasons of study 2017 and 2018.

Treatments			First Season2017(months)					Second Season2018(months)				
Propagation Methods	**Nitrogen fertilization**	**Soil Addition**	**1**	**2**	**3**	**4**	**Mean**	**1**	**2**	**3**	**4**	**mean**
Cutting tubers			**15.76**	**15.40**	**15.09**	**14.37**	15.15	**15.11**	**14.64**	**14.37**	**13.82**	14.48
Mini tubers			**15.45**	**15.10**	**14.77**	**14.02**	14.84	**14.73**	**14.55**	**13.69**	**13.28**	14.06
L.S.D.				**0.31**		**0.09**			**0.54**		**0.08**	
	100% mineral N		**13.95**	**13.55**	**14.48**	**12.30**	13.57	**12.42**	**12.09**	**14.02**	**11.12**	12.41
	50% mineral + 50% organic N		**15.16**	**14.77**	**15.58**	**13.84**	14.84	**14.73**	**14.23**	**14.45**	**13.37**	14.19
	25% mineral + 75% organic N		**16.34**	**15.96**	**16.27**	**14.96**	15.88	**15.94**	**15.81**	**15.86**	**14.53**	15.54
	100% organic N		**16.97**	**16.72**	**13.38**	**15.68**	15.69	**16.58**	**16.24**	**11.74**	**15.18**	14.93
	L.S.D.			**0.44**		**0.22**			**0.77**		**0.43**	
		EM	16.08	15.73	15.40	14.71	15.48	**15.52**	**15.34**	**14.81**	**14.07**	14.93
		Yeast extract	**15.17**	**14.87**	**14.47**	**13.75**	14.56	**14.30**	**13.98**	**13.14**	**13.12**	13.64
		Seaweed extract	**15.57**	**15.16**	**14.91**	**14.12**	14.94	**14.94**	**14.45**	**14.09**	**13.47**	14.24
		L.S.D.		**0.38**		**0.19**			**0.66**		**0.33**	
		EM	**14.26**	**13.82**	**15.33**	**12.48**	13.97	**13.43**	**12.98**	**14.98**	**11.89**	13.32
	100% mineral N	**Yeast extract**	**14.09**	**13.65**	**14.13**	**11.88**	13.44	**11.85**	**11.62**	**13.41**	**10.78**	11.91
		Seaweed extract	**14.12**	**13.70**	**14.87**	**12.02**	13.68	**12.93**	**12.27**	**14.17**	**11.11**	12.62
		EM	**16.02**	**15.79**	**16.18**	**14.68**	15.67	**15.87**	**15.08**	**15.72**	**14.01**	15.17
	50% mineral + 50% organic N	**Yeast extract**	**14.89**	**14.41**	**15.08**	**13.74**	14.53	**14.13**	**13.76**	**14.80**	**13.00**	13.92
		Seaweed extract	**15.19**	**14.95**	**15.63**	**14.13**	14.98	**14.94**	**14.31**	**15.16**	**13.88**	14.57
Cutting tubers		**EM**	**17.10**	**16.85**	**16.73**	**15.65**	16.58	**16.33**	**15.93**	**16.39**	**14.80**	15.86
	25% mineral + 75% organic N	**Yeast extract**	**15.84**	**15.53**	**16.19**	**14.85**	15.6	**15.70**	**15.09**	**15.60**	**15.39**	15.45
		Seaweed extract	**16.21**	**15.97**	**16.29**	**15.13**	15.9	**15.91**	**15.60**	**15.91**	**14.85**	15.57
		EM	**17.31**	**16.90**	**13.68**	**16.24**	16.03	**17.08**	**16.83**	**12.66**	**15.96**	15.63
	100% organic N	**Yeast extract**	**17.01**	**16.51**	**13.36**	**15.69**	15.64	**16.35**	**15.97**	**11.30**	**14.98**	14.65
		Seaweed extract	**17.11**	**16.72**	**13.53**	**15.95**	15.83	**16.77**	**16.23**	**11.98**	**15.18**	15.04
		EM	**14.01**	**13.69**	**15.18**	**12.87**	13.94	**13.04**	**12.86**	**14.54**	**11.83**	13.07
	100% mineral N	**Yeast extract**	**13.32**	**12.95**	**13.43**	**11.95**	12.91	**11.29**	**10.95**	**13.46**	**10.25**	11.49
		Seaweed extract	**13.93**	**13.51**	**13.94**	**12.62**	13.50	**12.00**	**11.87**	**13.54**	**10.86**	12.07
		EM	**15.88**	**15.48**	**16.10**	**14.59**	15.51	**15.19**	**14.82**	**15.51**	**13.90**	14.85
	50% mineral + 50% organic N	**Yeast extract**	**14.20**	**13.87**	**14.98**	**12.88**	13.98	**13.95**	**13.63**	**10.18**	**12.62**	12.6
		Seaweed extract	**14.79**	**14.12**	**15.52**	**13.04**	14.37	**14.29**	**13.78**	**15.31**	**12.83**	14.05
Mini tubers		**EM**	**16.91**	**16.45**	**16.47**	**15.27**	16.28	**16.23**	**17.59**	**16.22**	**14.86**	16.23
	25% mineral + 75% organic N	**Yeast extract**	**15.68**	**15.05**	**15.83**	**13.97**	15.13	**15.19**	**14.89**	**15.52**	**13.17**	14.69
		Seaweed extract	**16.32**	**15.92**	**16.09**	**14.87**	15.80	**16.27**	**15.76**	**15.53**	**14.13**	15.42
		EM	**17.18**	**16.83**	**13.50**	**15.92**	15.86	**16.95**	**16.65**	**12.45**	**15.29**	15.34
	100% organic N	**Yeast extract**	**16.30**	**16.97**	**12.74**	**15.03**	15.26	**15.93**	**15.94**	**10.88**	**14.75**	14.38
		Seaweed extract	**16.92**	**16.39**	**13.45**	**15.23**	15.50	**16.38**	**15.82**	**11.14**	**14.89**	14.56
	L.S.D.			**1.08**		**0.54**			**1.89**		**0.94**	

Table 5. Effect of propagation methods, nitrogen fertilizers and soil addition treatments as well as their interaction on protein% of potato tubers stored at room temperature during the two seasons of study 2017 and 2018.

Treatments			First Season2017(months)					Second Season2018(months)				
Propagation Methods	**Nitrogen fertilization**	**Soil Addition**	**1**	**2**	**3**	**4**	**Mean**	**1**	**2**	**3**	**4**	**mean**
Cutting tubers			**12.18**	**11.37**	**9.93**	**8.81**	10.56	**11.81**	**10.68**	**9.06**	**8.00**	9.87
Mini tubers			**11.56**	**9.93**	**8.68**	**7.18**	9.34	**10.68**	**8.93**	**7.62**	**6.06**	8.31
L.S.D.				**0.14**		**0.08**			**0.14**		**0.08**	
	100% mineral N		**11.13**	**10.06**	**8.37**	**7.62**	9.31	**10.56**	**8.93**	**7.31**	**6.43**	8.31
	50% mineral + 50% organic N		**13.06**	**12.31**	**10.68**	**9.31**	11.31	**12.25**	**11.43**	**10.06**	**8.56**	10.56
	25% mineral + 75% organic N		**12.56**	**11.43**	**10.06**	**8.62**	10.68	**11.81**	**10.81**	**9.21**	**7.68**	9.87
	100% organic N		**10.81**	**8.81**	**8.12**	**6.43**	8.56	**10.37**	**8.06**	**6.62**	**5.43**	7.62
	L.S.D.			**0.20**		**0.09**			**0.20**		**0.11**	
		EM	**10.75**	**9.43**	**7.81**	**6.75**	8.68	**10.43**	**8.68**	**7.06**	**6.00**	8.06
		Yeast extract	**12.06**	**10.75**	**9.31**	**8.31**	10.12	**11.31**	**9.93**	**8.50**	**7.18**	9.25
		Seaweed extract	**12.81**	**11.81**	**10.81**	**8.93**	11.12	**12.00**	**10.81**	**9.31**	**7.87**	10.00
		L.S.D.		**0.17**		**0.08**			**0.18**		**0.09**	
	100% mineral N	**EM**	**10.37**	**9.31**	**7.10**	**6.25**	8.31	**10.00**	**8.81**	**6.37**	**12.12**	7.75
		Yeast extract	**11.87**	**11.18**	**9.43**	**8.50**	10.25	**11.50**	**10.00**	**7.00**	**6.62**	8.75
		Seaweed extract	**12.62**	**12.00**	**10.81**	**9.18**	11.12	**12.37**	**11.06**	**9.62**	**8.18**	10.31
	50% mineral + 50% organic N	**EM**	**12.81**	**12.18**	**10.56**	**9.50**	11.25	**11.93**	**11.25**	**9.68**	**8.75**	10.37
		Yeast extract	**13.31**	**13.00**	**11.42**	**10.37**	12.00	**12.87**	**12.37**	**11.06**	**10.12**	11.56
Cutting tubers		**Seaweed extract**	**14.18**	**13.50**	**12.25**	**10.93**	12.68	**13.12**	**12.50**	**11.81**	**10.56**	12.00
	25% mineral + 75% organic N	**EM**	**11.25**	**10.18**	**9.12**	**8.37**	9.68	**10.93**	**10.50**	**8.81**	**8.00**	9.56
		Yeast extract	**13.18**	**12.50**	**10.93**	**9.50**	11.50	**12.68**	**11.93**	**10.62**	**9.18**	11.06
		Seaweed extract	**13.81**	**12.93**	**11.87**	**10.43**	12.25	**13.37**	**12.56**	**11.12**	**9.93**	11.75
	100% organic N	**EM**	**10.00**	**8.56**	**7.12**	**6.00**	7.87	**12.37**	**8.06**	**6.37**	**5.50**	8.06
		Yeast extract	**11.12**	**9.87**	**8.81**	**8.00**	9.43	**10.06**	**9.12**	**7.56**	**6.31**	8.25
		Seaweed extract	**12.25**	**11.31**	**9.68**	**8.75**	10.50	**10.68**	**10.18**	**8.75**	**7.12**	9.06
	100% mineral N	**EM**	**9.43**	**8.62**	**6.81**	**11.93**	7.62	**8.75**	**7.37**	**6.12**	**4.93**	6.75
		Yeast extract	**10.87**	**8.87**	**7.50**	**8.12**	8.81	**9.87**	**8.06**	**6.87**	**6.12**	7.68
		Seaweed extract	**11.87**	**10.50**	**8.62**	**8.06**	9.75	**11.00**	**8.31**	**7.87**	**7.00**	8.50
	50% mineral + 50% organic N	**EM**	**11.62**	**10.37**	**8.25**	**7.12**	9.31	**10.68**	**9.37**	**7.81**	**6.06**	8.43
		Yeast extract	**12.75**	**11.87**	**10.50**	**8.56**	10.87	**12.06**	**11.25**	**9.93**	**7.56**	10.18
Mini tubers		**Seaweed extract**	**13.68**	**13.06**	**11.18**	**9.37**	11.81	**12.93**	**12.00**	**10.18**	**8.37**	10.87
	25% mineral + 75% organic N	**EM**	**10.75**	**9.68**	**7.50**	**6.37**	8.56	**9.81**	**8.25**	**6.87**	**5.12**	7.50
		Yeast extract	**13.12**	**11.43**	**10.00**	**8.12**	10.62	**11.87**	**10.50**	**9.25**	**6.81**	9.56
		Seaweed extract	**13.18**	**12.06**	**11.00**	**9.25**	11.37	**12.37**	**11.18**	**9.31**	**7.18**	10.00
	100% organic N	**EM**	**10.00**	**6.81**	**5.93**	**4.93**	6.87	**9.25**	**5.81**	**4.87**	**4.00**	5.93
		Yeast extract	**10.50**	**7.25**	**6.25**	**5.37**	7.31	**956**	**6.50**	**6.12**	**4.87**	6.75
		Seaweed extract	**11.31**	**9.25**	**11.25**	**5.75**	9.37	**10.56**	**8.68**	**6.25**	**5.00**	7.62
	L.S.D.			**0.50**		**0.25**			**0.50**		**0.25**	

With regard effect of soil addition treatments on protein percentage of potato tubers during storage periods, data recorded in Table (5) show that soil addition with EM (10%), yeast extract (10%) or seaweed extracts (1%) significantly affected the protein percentage of potato tubers during both seasons of study. Such results indicate also that comparatively the highest protein percentages was recorded in case of using seaweed extract(10%) as average of both seasons, during the first month stored 12.48% and reached 8.48% after four months followed by yeast extract and EM as average of both seasons, during the first month stored 10.76% and reached 6.48% after four months **Kolodziejczyk (2016)** .

Such data in Tables (5) show clearly that the protein percentage of tubers was steadily and constantly decreased with prolonging the storage period. In this regard, the highest protein percentage was noticed during the first months stored lost (11.98 % and 11.25%) of first and second season respectively. On the contrary, the lowest protein percentage was noticed after four months (8.00% and 7.00%) during first and second season. Similar results were recorded in the two seasons of study.

With regard effect of the interaction on chemical contents of potato tubers **,** data presented in table (5) indicate that there were significant effects in studied tubers protein percentage due it the use of both propagation materials (cutting or mini tuber) ,various nitrogen fertilizer sources and three of soil addition substances through four months storage period at room temperature. In this regard, on obvious decreasing tendency in studied protein percentage could be recorded with the prolong storage period up to four months at room temperature .Moreover , the highest values of protein percentage was observed in case of using potato tubers previously produced from cutting tubers and plants were fertilized with 50% N in mineral plus 50% in organic form and the used soil was amended with seaweed extract (10%) as soil addition as average of both seasons, during the first month stored 13.63% and reached 10.75% after four months. On the contrary using pre harvest mini tuber and fertilized only with 100% in organic form and EM as soil addition recorded the lowest protein % at end storage period (4.44%).

Conclusion

It can be concluded, that under such conditions, stored potato tubers which resulted from planting by cutting tubers then fertilized with 100% of the recommended dose 120kgN/fed as organic fertilizer (chicken manure) combined with the soil addition of EM at 10% three times are recommended to obtain the lowest weight loss and decay and the highest dry matter, protein and starch content during storage period (4months) under room temperature condition.

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تاثير معاملات ما قبل الحصاد لطرق التكاثرو مصادر التسميد النتيروجينى والاضافة الارضية لبعض منشطات النمو على القدرة التخزينية لدرنات البطاطس المخزنة فى درجة حرارة الغرفة

محمد السعيد زكى –مصطفى حمزة محمد محمد– سمر سعيد حلاوة
قسم البساتين – كلية الزراعة – جامعة بنها

اجريت تجربتان خلال الموسم الصيفي لعامي 2017و2018 بمعمل اعداد وتداول وتخزين الحاصلات البستانية بقسم البساتين بكلية الزراعة جامعة بنها لدراسه تأثير طرق التكاثر المختلفة (التقاوي المجزأه– درنات الصغيره) ومصادر التسميد النيتروجيني المختلفة سواء المعدني او العضوي بالمعدل الموصي به 120 كجم نيتروجين للفدان (100% تسميد نيتروجيني معدني – 50% معدني + 50%عضوي – 25% تسميد نيتروجيني معدني + 75% عضوي –100%تسميد عضوي) والاضافة الارضية لبعض منشطات النمو (الكائنات الحية الدقيقة النافعة بتركيز 10% ومستخلص الطحالب البحرية بتركيز 1% ومستخلص الخميره بتركيز 10%) والتفاعل بينهم علي القدره التخزينية لنباتات البطاطس صنف اسبونتا .اثناء فتره الحصاد تم تجميع الدرنات من المعاملات المختلفه واجريت عملية الفرز والتعبئة في عبوات من الشبك زنه 2 كجم ثم التخزين في درجه حرارة الغرفه بمعمل اعداد وتداول وتخزين الحاصلات البستانية وتألفت كل مكرره من ثلاث عبوات من الشبك بحيث تم تخصيص عبوه لتقدير الفقد في الوزن وعبوتين لقياس نسبة التالف والتحاليل الكميائية ، كان متوسط درجة حراره الغرفه اثناء موسمي التخزين في 2017و 2018 .

تم فحص الدرنات واخذ القراءات المختلفة عليها مرة كل شهر، وكان اهم النتائج المتحصل عليها ان نباتات البطاطس المنزرعة بالتقاوي المجزاه والمسمدة بمعدل 100% سماد عضوي علي صورة سماد دواجن بالمعدل الموصي به وهو 120 كجم نيتروجين/فدان وكذلك الاضافة الارضية لكائنات الحية الدقيقة بتركيز 10% ثلاث مرات اعطت أقل نسبة فقد في الوزن وأقل نسبة تالف واعلي محتواه للدرنات من نسبة المادة الجافة والنشا والبروتين اثناء فترة التخزين (4 شهور) وذلك تحت ظروف التخزين في درجة حرارة الغرفة