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EFFECT OF SPROUTING INHIBITORS SUBSTANCES ON POTATO YIELD, TUBERS QUALITY, STORABILITY AND PLANT EMERGENCY.

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ABSTRACT: *This study was conducted at the Experimental Farm of the Faculty of Agriculture, Menufiya University and Laboratory of Horticulture Department in the same Faculty during the summer seasons of 2012 and 2013 and the winter seasons of 2012/2013 and 2013/2014 to study the effect of some sprouting inhibitor substances on potato yield, tubers quality , storability and plant emergency.*

The obtained results showed that soaking tubers in succinic acid, salicylic acid , eucalyptus or peppermint oils delayed sprouting of potato tubers during storage period (120 days) as compared with the effect of foliar spraying plants with previous substances before harvest. Tubers induced from plants or tubers treated with eucalyptus oil exerted the maximum No. of days for sprouting, and gave the lowest percentage of sprouts /tuber, followed by those of peppermint oil ,succinic acid and salicylic acid, respectively, with no significant differences between them.

Soaking potato tubers in eucalyptus oil before storage delayed sprouting of tubers and achieved the lowest percentage of sprouted eyes/tuber.

Significant differences in weight loss percentage were observed owing to the effect of foliar sprays of potato plants before harvest or soaking tuber seeds with succinic acid, salicylic acid, eucalyptus oil and peppermint oil during storage periods. The weight loss percentage was increased with increasing storage period up to 120 days. Soaking tubers before storage in solution of succinic acid, salicylic acid, eucalyptus oil and peppermint oil reduced the weight loss percentage comparing as foliar sprays with the above mentioned substances.

Starch contents in potato tubers significantly decreased, while reducing, non-reducing and total sugars contents significantly increased at the end of storage period compared with tuber contents at harvest. Foliar sprays of potato plants before harvest with the above mentioned sprouting inhibitor substances gave the lowest value of starch contents in tubers at the end of storage period compared with soaking tubers soaked in those substances before storage. Soaking tubers in succinic acid, salicylic acid, eucalyptus oil and peppermint oil gave the lowest values of reducing sugars, non-reducing and total sugars content in potato tubers at the end of storage period .

The lowest values of reducing, non-reducing and total sugars content in potato tubers at the end of storage period were obtained with treating potato by eucalyptus oil.

The percentage of germination gradually increased with increasing the periods after planting. The percentage of plant emergence showed highly significant differences due to different the treatments. The untreated (control) potato plants produced the highest percentage of plant emergence at all the periods of emergency. Foliar sprays of potato plants before the harvest of summer seasons exerted the lowest percentage of plant emergence after planting tubers seeds in the next winter seasons compared with those of soaking seeds before storage. The untreated potatoes (control) were the fastest emergence after planting and gave the highest percentage of plant emergence at the end of emergence period (41days from planting). Foliar sprays of potato plants before harvest with succinic acid or eucalyptus oil gave the slowlest emergence and the highest emergence percentage at the end of emergence period (41days)when seed tubers planted in the next winter seasons. Foliar spraying of potato plants with peppermint oil and salicylic acid decreased the rate of plant emergence and the percentage of germination as compared with control at 41days after planting .

***Key words**: Sprouting inhibitors, succinic acid ,salicylic acid, eucalyptus oil peppermint oil storability.*

INTRODUCTION

Potato (*Solanum tuberosum L*.) is popularly vegetable crop and has emerged as fourth most important food crops for human being after rice, wheat and maize . The dry matter, edible energy and edible protein contents of potato makes it nutritionally superior vegetable as well as stable food not only in our country but also throughout the world. Hence, potato may prove to be a useful tool to achieve the national security of the nation.

It has been revealed that, according to FAO, potato is consumed by more than one billion people over the world . The protein of potato has high biological value than proteins of cereals and even better than that of milk. Potato has a high biological value because it is rich source of protein, vitamin, carbohydrates and iron. The carbohydrates, which constitute about 75%of the total dry matter are the main energy source. For example, in Great Britain potatoes were estimated to contribute 3.4%of total protein consume compared with 4.6, 4.8 and 5.8% contributed by eggs, fish and cheese, respectively. Amino acids analysis are shown that potatoes are a very good source of lysine. However, they have lower concentration of sulphur-containing amino acids i.e. methionine and cysteine (Woolfe . 1986).

Tubers of the potato can remain suitable for consumption or processing through periods of storage after harvest. Long storage life has helped to make potato tubers one of the most important foods worldwide, and enables the potato processing industry to operate year-round in location where potatoes can only be produced during a favorable particular growing season.

If the natural duration of tuber dormancy is shorter than the desired period of storage, the tubers will sprout during storage. Sprouting reduces tuber quality for marketing, processing and consumption.

Suppression of sprouting is key to the maintenance of potato post-harvest quality. Therefore, several methods and applications have been developed to delay or prevent sprouting. The ideal potato sprout inhibitor would have several properties (a)it must effectively suppress sprouting at low dosage rates, (b)it might has no effect on tuber quality (i. e. fresh weight, sugar content, appearance ..etc) (c) it must be low toxicity and pose no residue problems to humans, and (d) it should break down rapidly. Thus, nature products in the environment are use for a very suitable inhibitor for sprouting in plants such as eucalyptus oils which already commonly accepted in the human diet.

Essential oils are of a great importance as sprout inhibitors, this group includes several related volatile aromatic which are extracted from plants or plant parts. Mint and eucalyptus are natural oils which found to be used successfully to delay or inhibit sprounting in potato.

Also, natural synthesized compounds such as succinic and salicylic acids have inhibitory effect on sprounting via their inhibition effect on enzymes activity which reflected on growth of various plant organs (Rao *et al.* 1997, Tarchevsky *et al.* 1999 and Panina *et al.,* 2004).

MATERIALS AND METHODS

This study was conducted at the Experimental Farm of the Faculty of Agriculture, Menufiya University and Laboratory of Department of Horticulture in the same Faculty during the summer seasons of 2012 and 2013 . Two field experiments were carried out on potato "*Solanum tuberosum* L." var. Diamant to investigate the effects of some sprouting inhibitors, natural substances (peppermint and eucalyptus oils) or safe natural synthetic compounds (succinic and salicylic acids) on yield, tubers quality and storability of potato tubers, as well as plant emergency.Seed tubers were planted in rows 5m. in length and 70cm. in width and 25cm. between seed tuber pieces in January 31 and 23 in the first and the second seasons, respectively of 2012 and 2013.Potato plants sprayed by succinic acid, salicylic acid, eucalyptus oil and peppermint oil with 200 ppm three times at 6o, 70, and 80 days after planting, each

treatment replicated tree times and arranged in complete randomized black design.

Chemical compositions of Mint and Eucalyptus essential oils were recorded in Tables (1 and 2).

The all other agricultural practices were conducted according to the used methods in the college farm.

After harvesting the following data were recorded:

1. Average tuber weight/g.
2. Total tuber yield /plant (g).
3. Total yield of tuber (ton /fed).
4. Percentage of small tubers (less than35mm) .
5. Percentage of medium tubers (36-49mm).
6. Percentage of large tubers (over 49mm).
7. Storability evaluation:
8. Specific gravity
9. Starch%
10. Dry matter%

Table(1): Certificate analysis of peppermint oil.

Constituents	%
L-Menthol	30.70
L-Menthone	27.08
Methyl acetate	4.95
Iso menthone	4.35
Mentha furan	4.79
L-Limoninc	2.99
Cineol	5.76

Table (2): Relative percentage composition essential oils of Eucalyptus leaves.

Constituents	%
α-Pinene	3.27
A-Cymene	1.76
(+)Limonene	28.82
1.8-cineole	5.39
-Terpinolene	9.4
(-)lsopulegol	-
Beta-citronellal	0.8
Isopulegol	-
β-Citronelloj	-
Z-Ciral	10.77
Trans-geraniol	4.2
E-Citral	14.16
Methylgranate	3.66
Geraniol acetate	3.86

Fifteen kg of tubers from each treatment were stored at 5 ± 1ºC and 80-85% humidity (RH). At the same time, 15 kg (three replicates)of tubers from control treatment were soaked 30minute at 200ppm of succinic acid salicylic acid, eucalyptus oil or peppermint oil and stored under the same condition of cold storage and the following data were recorded:

1.Number of days for sprouting.

2.Percentages of sprouting: Sprouting percentage was calculated every 30 days up to 4 months as follows**:**

$$Sprouting\ \% = \frac{Number\ of\ sprouting\ potato\ tubers}{Total\ number\ of\ samples\ tubrs} \times 100$$

3. Potato tubers weight loss percentages:

At 30 days intervals, tubers were weighed and % of weight loss was calculated then the total weight loss % was recorded at the end of storage period.

4. Reducing, non-reducing and total sugars:

It were determined colorimetrically according to Forsee (1938)and Morell(1941)and were calculated as g /100 g. dry weight.

5. Starch content:

It was determined in dry matter of tubers according to A.O.A.C.(1970).

6. Percentage of germination

At the end of storage period (120days), hundred uniform seed tubers were divided to four replicates (25tubers in each replicate)were planted in I and 3 October of 2012/2013 and 2013 /2014 (winter season). Emergence and the percentage of sprouting were recorded at 18,21, 24, 27,30, 33, 36 and 41days from planting to evaluate the effect of varios applications on sprouting and tuber emergency, under field condition.

$$\text{Percentage of germination} = \frac{\text{Number of grminated seeds}}{\text{Total number of seeds}} \times 100$$

- **Statistical analysis:**

All obtained data of the present study during the both growing seasons were subjected to statistical analysis of variance using the normal F. test, and means were compared by least significant difference (LSD) at 0.05 level of probability according to the methods of Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Effect of foliar application with some sprouting inhibitor substances on potato summer yield and its components.

It is obvious from such data presented in Tables (3 and 4) that , spraying potato plants at three times 60, 70 and 80 days after planting with some growth inhibitors and plant extract substances showed insignificant effect on yield/plant and total yield (ton/feddan), in both. In general, spraying potato plant with succinic acid, salicylic acid , eucalyptus oil and peppermint oil (all treatments) significantly decreased average tuber weight as compared with the control. In this respect, the highest average tuber weight was obtained in control treatment , while the lowest average tuber weight was produced when potato plants sprayed with peppermint oil before harvest in both summer seasons .

The results of this experiment show significant effect of foliar application with some sprouting inhibitor substances on tubers size grade as weight percentage are present in Table (3). It can be clearly seen from such data that, the tested of some growth inhibitors and some plant extract did not show significant effect on the percentage of small size grade of tubers (less than 35mm), whereas the same treatments show significant effect on both of medium (36-49mm)and large tuber size (>49mm)grade in the two summer seasons. Thus, foliar application of succinic acid, salicylic acid , eucalyptus oil and peppermint oil reduced the percentage of large tuber size (>49mm)and increased significantly the percentage of medium tuber size (36-49mm)as compared with control treatment. In this connect, data in Table (4) show clearly that foliar application of peppermint oil at three times 60, 70 and 80 days after

planting achieved the lowest percentage of large tuber size and the highest percentage of medium tuber size. On the other hand, the highest percentage of large tuber size and the lowest percentage of medium tuber size recorded in control plants was obtained in control. These results are true in summer seasons.

The reduction of tuber size may be due to the inhibitory effect of eucalyptus extracts and Peppermint on some crops (Zhang and Shenglei, 2010). Leaf extract of eucalyptus inhibited and reduced root and shoot lengths of cucumber (Allolli and Narayanareddy, 2000) and cowpea (Djanaguiraman *et al.,* 2002). These results are in agreement to those obtained by (Djanaguiraman *et al.,* 2005) who found that fresh and dry weights of some crops were also reduced significantly by using eucalyptus leaf extract. Crawley(1997) and El-Darier, (2002) indicated that the interference with nutrient uptake and reduction in nutrient accumulation is one of the most effective mechanisms of phenolic compounds action. Many polyphenols of eucalyptus leaf extracts have catechol groups and at higher concentrations can chelate divalent or trivalent metal ions. Therefore, the inhibit ion uptake and thus cause reduction in dry matter accumulation in broad bean and maize plants . Eucalyptus leaf extracts interfere in mitosis of growing cells and respiration and reduce photosynthesis (Batish *et al.,* 2004). However, the reduction in dry matter accumulation with succinic acid may be due to the influence of succinic acid on the activity of antioxidant enzymes . Also, catalase enzyme molecular forms in different plant organs can have equal sensitivity to salicylic acid (Chen *et al.,* 1997) and inhibition of enzyme activity (Rao, *et al* ., 1997).

Table (3): Average tuber weight (g)/tuber, total yield /plant (g)and total yield (ton)/fed (at 110 days after planting) as affected by sprouting inhibitor substances treatments during the summer seasons of 2012 and 2013.

Characters / Treatments	Average tuber weight (g)/tuber		Total yield/ plant(gm)		Total yield (ton)/fed	
	(2012)	(2013)	(2012)	(2013)	(2012)	(2013)
Control	90.91	101.40	441.46	438.90	10.60	10.53
succinic acid	88.14	90.71	427.88	439.93	10.27	10.56
salicylic acid	92.17	91.14	447.88	415.89	10.75	9.98
eucalyptus oil	89.92	92.26	442.46	441.13	10.62	10.59
peppermint oil	78.15	88.59	445.83	429.75	10.70	10.31
L.S.D.5%	4.18	3.11	N.S	N.S	N.S	N.S

Table (4): Weight percentage of small, medium and large tubers/plot (at 110 days after planting) as affected by sprouting inhibitor substances treatments during the summer seasons of 2012 and 2013.

	First season(2012)			Second season(2013)		
Characters / Treatments	Tubers Weight %			Tubers Weight %		
	S	M	L	S	M	L
Control	8.40	35.77	55.83	6.55	37.84	55.61
Succinic acid	9.07	40.99	49.94	7.00	47.09	45.91
Salicylic acid	8.29	41.99	49.72	7.53	42.26	50.21
Eucalyptus oil	8.81	42.67	48.52	7.12	44.61	48.27
Peppermint oil	8.82	44.12	47.06	7.77	48.64	43.60
L.S.D.5%	N.S	2.88	3.91	N.S	4.17	5.11

S=Small size (less than 35mm.) M=Medium size(36-49mm.) L=Large size (over 49mm.)

1.2. Effect of foliar application of some sprouting inhibitor substances on tuber quality.

Data illustrated in Tables (5 and 6) imply the distinct effect of succinic acid, salicylic acid, eucalyptus oil and peppermint oil on specific gravity, starch and dry matter contents as well as total, reducing and non – reducing sugars in potato tubers before storing in the two summer seasons .Generally, it could be concluded from these results that all investigated treatments significantly increased specific gravity, starch and dry matter contents in tubers at harvest and before storing comparing with check treatment(control). Moreover, it is important to point out that spraying potatoes with peppermint oil gave the highest record of specific gravity, starch %, dry matter % and sugars contents in tubers and followed by those of salicylic acid, succinic acid and eucalyptus oil, respectively. These results are true at both growing summer seasons. Data presented in the same tables (5 and 6) generally show that there was insignificant differences of these characteristics among treatments.

These results are partially close to those obtained by Midan, Sally *et al.* (2007) who indicated that increases in starch %, dry matter percentages and total carbohydrates contents as well as specific gravity were noticed due to foliar spraying of salicylic acid. In addition , increasing specific gravity in tubers cold be explained as a result of increasing dry matter and starch content due to salicylic acid treatment .

Table (5): Specific gravity, starch percentage and dry matter percentage tubers quality at harvest as affected by growth substances treatments during the summer seasons of 2012 and 2013.

Characters / Treatments	Specific gravity		Starch%		Dry matter%	
	(2012)	(2013)	(2012)	(2013)	(2012)	(2013)
Control	1.062	1.067	9.78	11.22	16.42	17.47
Succinic acid	1.073	1.080	12.10	13.80	18.74	20.21
Salicylic acid	1.076	1.081	12.73	14.00	19.37	20.43
Eucalyptus oil	1.073	1.079	12.10	13.60	18.74	20.00
Peppermint oil	1.078	1.083	13.16	14.40	19.79	20.85
L.S.D.5%	0.004	0.005	0.78	0.91	1.04	1.13

Table (6). Reducing , non - reducing and total sugars (content of tubers basis) at harvest as affected by foliar sprays with Succinic acid, Salicylic acid, Eucalyptus oil and Peppermint oil in summer seasons of 2012 and 2013.

Characters / Treatments	Reducing sugars %		Non reducing sugars %		Total sugar%	
	(2012)	(2013)	(2012)	(2013)	(2012)	(2013)
Control	0.151	0.147	0.581	0.732	0.732	0.879
succinic acid	0.129	0.125	0.493	0.461	0.622	0.586
salicylic acid	0.136	0.131	0.511	0.573	0.647	0.704
eucalyptus oil	0.128	0.127	0.509	0.493	0.637	0.620
peppermint oil	0.119	0.111	0.485	0.443	0.604	0.554
L.S.D.5%	0.008	0.007	0.025	0.024	0.031	0.031

The increases in tuber starch , dry matter contents and specific gravity that resulted from application of antioxidant substances such as salicylic acid and extract of some plants inhibitors such as eucalyptus oil and peppermint oil were attributed to its effect on raising the activation of net assimilation (Rojo *et al*, 2011), who indicated that salicylic acid activated plant defense and favored photosynthetic translocation and improved tuber quality, induced higher biological activity and reduced damage which are associated with high hydrogen peroxide. Also, they concluded that salicylic acid suggesting an important role in regulating these molecules contracting pathogen effect which directly improve the tuber quality. Tarchevsky *et al.*, (1999) indicated that hydrogen peroxide formation in mitochondria of plant cells depends on the content of succinic acid as substrate of oxidation. It is possible to believe that the succinate-dependent H_2O_2 formation is capable to the influence on the activity of antioxidant enzymes, thereby that its effect on assimilation of carbohydrate in plant tissues. Furthermore, the favor effect of growth inhibitors such as succinic acid which largely related to the promotion of the photosynthetic apparatus of the chloroplast and such promotion increased the sink activity of the tubers as well as the translocation of assimilation to tubers which inturn increased dry matter accumulation and starch contents in potato tubers (Kolupaev *et al.*, 2011). Javaheri *et al.* (2012)suggested that salicylic acid (SA) or ortho- hydroxyl benzoic acid and other salicylates are known to affect various physiological and biochemical activities of plants and may play a key role in regulating their growth and productivity. Hayat *et al.* (2010) show that salicylic acid is considered to be an endogenous growth regulator of phenolic nature that enhanced dry mass production in corn and soybean (Khan *et al.,* 2003). Fariduddin *et al.* (2003) reported that the dry matter accumulation was significantly increased in *Brassica junces*, when lower concentrations were sprayed. However, higher concentrations of salicylic acid had an inhibitory effect.

Regarding non- reducing, reducing and total sugars contents in potato tubers, the level of sugars in potato tubers is an important factor affecting quality in potatoes, especially colour of processed potato products (Smith, 1987), sugar are generally considered to be the most important ones (Roe *et al.* 1990). Sugar content in potato tubers are conditioned by several factors which include genotype, the environmental conolitions and cultural practices during growth, and several post- harvest factors including storage. As known, the higher amounts of reducing sugar produce dark, bitter- taste in fried potato products , because of Maillard reaction between reducing sugar and free amino acid at frying temperature (Vattem and Zhetty , 2003).

Results presented in Table (6) showed that non-reducing, reducing and total sugars contents in potato tubers decreased significantly by foliar application of succinic acid , salicylic acid, eucalyptus oil and peppermint oil at three times 60, 70 and 80 days after planting in the two growing summer seasons. In this regard, it is easily to conclude from these data that control treatment (without foliar spraying of substances)gave the highest total, reducing and reducing sugars contents in potato tubers at harvest, whereas spraying potato plants before harvest with peppermint oil produced the lowest values of reducing , non-reducing and total sugars content in tubers followed by foliar application with succinic acid, eucalyptus oil and salicylic acid , respectively.

These findings are in agreement with those reported by Frazier *et al.* (2004) who found that oils of some herbs and spices essential oil such as peppermint and spearmint oils have been shown to reduce total and reducing sugar in potato tubers and can be application to certified organic crops. Spraying potatoes with essential oils is associated with conversion of starch to sugars, thus these compounds are related to hydrogen peroxide. Hydrogen peroxide is more correctly the darkening of fried products. Also, Rojo (2011) concluded that spraying potatoes with salicylic acid improved photosynthate translocation,

increased starch content, decreased reducing sugar content and consequently improved tuber quality especially colour of processed potato products. Kolupaev *et al.* (2011) pointed out that the action of salicylic and succinic acids closed the reduce content of lipid peroxidation and reducing sugar. Also, EL-Seifi (1978) indicated that reducing, non-reducing and total sugars in potato tubers were not statically influenced by growth inhibitors substances, while starch contents in tubers significantly increased . This result might be due to that most of the sugars content is converted to starch at the fully mature stage of tuber.

2.Storability.

2.1. Residual effect of foliar spraying plants or soaking tubers with some sprouting inhibitor substances.

2.1.1.Numbe r of days for sprouting and percentage of sprouting /tubers during storage period.

The cultured process tubers during the period of storage of critical points as that of the process paths first negative when the storage for consumer purposes as the sprouting leads to reduce the qualitative value of the tubers and increase the percentage of weight loss and the percentage of damage (Asgar and Asandhi, 1993). The second positive when the storage of seeds, especially those stored in June and intended to be planted in the autumn and the subsequent that are stimulated by the farming season and in line with number of main stems required per unit area (16 major leg / m^2) (Vander zaag, 1980).To increase efficiency in both tracks and so does not depend on the use of cold storage only to prevent or inhibit sprouting of potato tubers. Thus, a lot of researchers and those interested in the storage and production of potato tubers to treat many of the chemical compounds to achieve this, according to the need and the vehicles to prevent the stimulus in a commercial scale is Malic Hydrazide (Smith, 1968). But it is a result of the adverse impact of these chemicals in the environment and public health and because of the practical approaches towards leaving everything factory and the chemical has a negative impact on health and the environment called a lot of those interested in the environment safety to refrain from the use of these vehicles and the trend towards the use of plant extracts substitute for chemicals substances (AL-Barzinji *et al.,* 2002). Moreover, he added that plant extracts and volatile oil used in potato tubers to inhibit sprouting in tubers during storage periods and keep tuber for longer time condition and increases storability of potatoes.

Based on the foregoing and to reduce storage costs radiator and keeping it for a longer tubers condition physicals, marketing and use of plant extracts to test their impact on the growth of sprouting and storability of tubers at temperatures condition of 5^0c and15 ^{0}c (Bang,1995). Sprouting of the tubers indicate a breakage of dormancy and consequently the commencement of some other successive physiological proses, ending with termination of apical dominance. By the end of the apical dominance the lateral buds, early under cold storage conditions, means that potato tubers lost a high proportion of its quality and consequently its marketing ability.

The data in Tables (7 and 8) indicated that significant differences in the number of days for sprouting of tubers were observed owing to the methods of application of some sprouting inhibitor substances and essential oil extract. In this connect, soaking tubers before storage with some sprouting inhibitor substances increased number of days for sprouting tubers and reduced the percentage of sprouted eyes/ tubers as compared with foliar sprays plants before harvest. It is important to point out that soaking tubers with succinic acid, salicylic acid , eucalyptus oil and peppermint oil delayed sprouting of potato tubers during storage period (120 days) as comparing with residual effect of foliar spraying plants with those substances before harvest.

The results in the same Tables (7 and 8) also revealed that tubers induced from plants or tubers treated with eucalyptus oil

exerted the maximum No. of days for sprouting tubers and gave the lowest percentage of sprouted /tubers, follows by those of peppermint oil , succinic acid and salicylic acid, respectively, with no significant differences between them, whereas untreated plants or tubers (control)showed the minimums days for sprouting and the highest percentage of sprouted eyes/tubers. These results are true when potato tubers stored in cold storage conditions 5 ± 1°C and relative humidity of 80-85%, for four months in the two summer seasons (2012 and 2013).

Regarding the interaction effect of method of application and the different sprouting inhibitor substances, results in Tables (7 and 8) show obviously that soaking potato tubers in eucalyptus oil before storage delayed prouting of tubers and achieved the lowest percentage of sprouted eyes/tubers, while control treatment haste sprouting of tubers and increased the percentage of sprouted eyes/tubers during storage period (120 days)

Table (7): Effect of foliar spraying plants or soaking tuber seeds with some sprouting inhibitor and plant extracts on storability of potato tubers during storage period in 2012 summer season.

		First season(2012)					
Characters / Treatment (A) / (B)		No of days for sprouting	Percentage of sprouting / tuber(%)	Potato tubers weight loss percentages			
				30 days	60 days	90 days	120 days
Foliar Spraying	Control	78.00	30.87	3.24	5.63	7.59	15.18
	Succinic acid	86.50	8.88	2.95	3.93	4.29	7.58
	Salicylic acid	86.50	12.52	2.80	3.89	3.98	6.96
	Eucalyptus oil	92.50	4.87	2.44	3.13	3.60	6.20
	Peppermint oil	89.50	6.36	2.94	3.66	4.32	7.64
	Means	86.60	15.88	3.07	4.25	4.96	8.91
Soaking tubers	Control	79.00	36.87	3.23	4.88	6.87	13.74
	Succinic acid	99.50	7.11	1.40	2.22	2.94	5.88
	Salicylic acid	99.00	8.16	1.79	2.38	3.34	6.68
	Eucalyptus oil	104.50	3.11	1.33	1.97	2.40	4.80
	Peppermint oil	99.00	4.83	1.48	2.36	3.23	5.46
	Means	96.20	12.02	1.85	2.76	3.76	7.31
average (AB)	Control	78.50	33.87	3.24	5.26	7.23	14.46
	Succinic acid	93.00	8.00	2.18	3.08	3.62	6.73
	Salicylic acid	92.75	10.34	2.30	3.14	3.66	6.82
	Eucalyptus oil	98.50	3.99	1.89	2.55	3.00	5.50
	Peppermint oil	94.25	5.60	2.21	3.01	3.78	6.55
L.S.D.5%	(A)	4.15	0.38	0.43	0.64	0.81	0.65
L.S.D.5%	(B)	3.96	4.13	0.16	0.31	0.55	0.73
L.S.D.5%	(AB)	6.81	7.55	1.45	1.57	2.11	2.09

Table (8): Effect of foliar spraying plants or soaking tuber seeds with some sprouting inhibitor and plant extracts on storability of potato tubers during storage period in 2013 summer season.

		Second season(2013)					
Characters / Treatment (A)	(B)	No of days for sprouting	Percentage of sprouting/ tuber(%)	Potato tubers weight loss percentages			
				30 days	60 days	90 days	120 days
Foliar Spraying	Control	79.50	28.87	3.94	5.63	7.89	15.78
	Succinic acid	89.50	8.31	2.51	3.34	5.53	8.06
	Salicylic acid	89.00	11.33	2.73	3.51	4.48	8.96
	Eucalyptus oil	94.50	4.11	2.51	3.11	3.80	6.60
	Peppermint oil	91.00	5.32	2.54	3.24	4.28	7.56
	Means	88.70	11.59	3.05	3.97	5.20	9.39
Soaking tubers	Control	78.00	34.97	3.23	4.98	7.12	14.24
	Succinic acid	98.50	7.01	1.10	1.40	1.90	3.80
	Salicylic acid	98.00	7.00	1.18	1.53	2.33	4.66
	Eucalyptus oil	103.50	2.73	0.99	1.38	2.43	4.86
	Peppermint oil	98.00	4.15	1.37	1.89	2.55	5.1
	Means	95.20	11.17	1.57	2.24	3.27	6.53
average (AB)	Control	78.75	31.92	3.59	5.31	7.51	15.01
	Succinic acid	94.00	7.66	1.81	2.37	3.72	5.93
	Salicylic acid	93.50	9.17	1.96	2.52	3.41	6.81
	Eucalyptus oil	99.00	3.42	1.75	2.25	3.12	5.73
	Peppermint oil	94.50	4.74	1.96	2.57	3.42	6.33
L.S.D.5% (A) L.S.D.5% (B) L.S.D.5% (AB)		2.34 5.11 7.83	2.44 3.67 6.26	0.55 0.19 1.23	0.63 0.39 1.84	1.11 1.63 2.18	1.23 2.64 2.71

Obtained results are in conformity with those of Batish *et al.* (2004) suggested that the eucalyptus globules essential oil caused inhibition in germination of *Raphanus sativus.* The mechanism with which the eucalyptus essence prevents germination was completely unknown. However, some researches show that volatile monoterpens like cineole stop the mitosis (Rassaefarl *et al.,* 2013). The extracted essential oils from eucalyptus inhibits germination and growth of the eyes of potato(sprouts)by killing meristem cells (Vaughn, 1991). The growth of most onion cells which are carved by cineole stop at interphase stage, and a few of the cells will stop in the other mitosis phases. Abrahim *et al.,* (2000) reported that the interference of monoterpenes of eucalyptus in the respiratory activities of plant can be the evidence of reduction in germination. Vokou *et al.,* (1993)indicate that the use of aromatic plants could be an effective and sat way to prolong the storage life of potato tubers , at the same time

protecting them from certain microbial attack. Midan *et al.,* (2007) show that soaking tuber seeds of potato with salicylic acid and some growth regulator are more effective in tuber quality comparing with foliar application. Also, Frazier *et al* (2004) reported that effective sprout control is a major component of managing stored potato quality. If proper control is not maintained significant reduction to tuber quality will occur, and the ability to store for extended periods of time is diminished. Sprouting causes increased weight loss and may impede airflow through the potato pile. Sprouting is also associated with the conversion of starch to sugars. They added that, peppermint oil applied in storage can be used as effective sprout suppressants. A wick application of this oil gave better sprout control. Xin Song et al. (2003)show that treating seed tubers of potatoes with essential oils delayed the emergence of sprout in tubers. Fikreyesus *et al.* (2011) found that leaf extract of eucalyptus globulus inhibited germination of tomato. Salicylic acid and other salicylates are known to effect various physiobgical and biochemical activities of plants and may play a key role in regulating their growth (Hayat *et al.,* 2010). Fariduddin *et al.,* (2003) reported that the effect of salicylic acid on sprout growth attributed to the dry matter accumulation in tubers, spraying plants with salicylic acid was significantly increased dry matter accumulation, while higher concentration of salicylic acid had an inhibitory effect on sprouting.

The inhibitory effect of essential oils eucalyptus, peppermint and caraway is exerted not only against other plant species but also against the progeny of producing plant particularly for seed germination and seedling growth. Carvon and monoterpene keton, found in peppermint and eucalyptus oils inhibits the sprouting of potato (Bang,1997). Hartmans *et al.*(1993) found that the compound Carvone which is one of caraway, peppermint and eucalyptus oils inhibiting the germination eyes of potato tubers equation for the efficiency of the treatment of tubers textured of TPC and CIPC has extended effect for a long time as long as 240 days, and is believed to cause inhibition of sprout growth due to inhibition of enzyme Hydroxymethylglutaryl COA reductase.

2.2. Weight loss percentage.

Storage losses are often specified as weight losses in the quality of potatoes, which are caused by respiration (Basker, 1975); sprouting (Amoros *et al.,* 2000); evaporation of water from the tubers (Kabira and Berga, 2003. Data show clearly in Tables (7 and 8) that the weight loss percentage was increased with increasing storage period up to 120 days in the two growing seasons Regarding the effect of method of application on weight loss percentage , data at the same Tables indicated that soaking tubers before storage in solution succinic acid, salicylic acid, eucalyptus oil and peppermint oil reduced the weight loss percentage comparing as foliar sprays with the abovementioned substances.

It can be clearly seen from the data listed in the abovementioned table that all the used substances treatments caused a significant effect on weight loss percentage during cold storage of potato tubers (120 days) .In this connection, the highest value of weight loss percentage was obtained of control treatment, whereas the lowest values of weight loss percentage were obtained from treating potatoes with eucalyptus oil, followed by those of peppermint oils, succinic acid and salicylic acid, respectively, in the two summer seasons.

This observation may be attributed to the increase in dry matter accumulation in tubers owing to the foliar sprays of potato plants 30 days before harvest and therefore they contained less water content, also soaking tubers in these substances reducing in sprouting over the entire storage period. The high moistave content in tubers apparently were more suitable for high activities of the hydrolyzing enzymes, which are necessary for the promoting of sprouts growth. Park *et al.* (2009) stated that the sugar content at harvest is one of the important parameters determine the maturity and sprouting vigor of potato tubers,

because sucrose, glucose and fructose are known to play a primary role in the sprouting metabolism. This statement is in accordance with our results concerning the low content of reducing sugars in potato tubers of the a forenamed treatments, which were found and discussed previously. Obtained results are in harmony with those of AL-Zubaidy(2002) found that the percentage of loss weight tubers stored at cold storage has gradually increased with the duration of storage and up to the top rate at the end of the storage period of 120days . It was also noted that the plant extracts used reduced the percentage of loss in tubers storage at low temperature. The reason for the low percentage of lost weight tubers treatment with plant extracts at the end of a period of adjustment may be due to the low percentage of eyes germinated and the number of buds germinated as well as the low rate of respiratory rate in the tubers in which cultured happen .

On the other hand, increasing the percentage of lost weight tuber under control plants may be due to the increase of the percentage of sprouting /tubers Table same (7 and 8). According to our results, Rice(1984), Alloli and Narayanareddy (2000) they indicated that several phenolic compounds in leaf extracts of three eucalyptus hybrids reduced respiration. Moreover, the highest values of weight loss percentage obtained by control treatment may be explained that such tubers contain less dry matter (Table 3) and therefore have higher moisture content and consequently early sprouting (Table 7 and 8) the high moisture and sugars contents in tubers more suitable to activate the hydrolyzing enzymes, which are responsible for the conversion of the tuber starch into mono-saccharides. These latter compounds are more easily to be lost by the increased respiration of the sprout tubers.Thus, Midan Sally et al (2007)indicated that soaking tuber seeds of potatoes in salicylic acid increased conversion of the starch into mono-saccharides .Frazier *et al.* (2004) suggested that sprouting causes increased weight loss and may impede airflow through the potato pile. In addition, peppermint oil applied in storage of potato tubers can be reduced respiration and delayed sprouting which inturne decreased weight loss percentage. Frequent, repeated application are necessary for adequate long-term sprout control. The eucalyptus oil is composed of the mixture of several monoterpenes. Abrahim et al. (2000) reported that the interference of monoterpenes in the respiratory activities of plant can be the evidence of reduction in sprouting. The reduction in respiratory activities decreased the percentage of weight loss which could be an effective and safe was to prolong the storage period of potato tubers, at the same time protecting them from certain microbial attacks (Vokou *et al.* 1993).

2.3.The changes in starch and sugars content in tubers at the end of storage period.

The starch and sugar content in potato tubers at harvest is one of the important parameter determine the maturity and sprouting vigor of potato tubers, because sucrose, glucose and fructose are known to play a primary role in the sprouting metabolism (Park *et al.* ,2009). The treatments of some growth inhibitors and plant extract before harvest and during storage must be accumulated less reducing sugars during storage period. As for as browning development in fried potato products is concerning, the reducing sugars (glucose and fructose) have been shown to be the limiting factors(Roe and Faulks, 1991). As known, the higher amounts of reducing sugars produce dark, bitter-taste in fried potato products, because of the Maillard reaction between reducing sugars and free amino acids at frying temperature (Vattem and Shetty, 2003).

Data of starch and sugars contents in potato tubers at harvest and at the end of storage period under cold storage (5 ± 1^{o}C and 80-85% RH)are presented in Table (4) at harvest and Tables (6 and7) at the end of storage period .

Generally, starch contents in potato tubers significantly decreased, while reducing, non-reducing and total sugars

content significantly increased at the end of storage period compared with tuber contents at harvest (Table 6). These results may be due to increasing respiration rate, increasing early sprouting and percentage of sprouting/tubers and storage tubers for long period (120 days. It can be observed from the previous data that the decreases in starch concentration(starch%) of control treatment reached about 21.98%in the first season and 19.16%in the second season compared with the other treatment. whereas the increases in reducing , non-reducing and total sugar at the end of storage period reached about 14.56%, 21.51% and 20.08% in 2012season and 14.96%, 9.56% and 10.35% in 2013 summer season , respectively.

Regarding to the effect of method of application with succinic acid, salicylic acid, eucalyptus oils and peppermint oils on starch and sugars contents at the end of cold storage period (120 days), the recorded data in Tables (9 and 10) show that foliar sprays potato plants at 30 days before harvest with the above sprouting inhibitor substances gave the lowest value of starch contents in tubers at the end of storage period compared with tubers soaked in those substances before storage. However, soaking tubers in succinic acid, salicylic acid, eucalyptus oil and peppermint oil gave the lowest values of reducing sugar, non-reducing and total sugar content in potato tubers at the end of storage period under cold store conditions (5 ± 1^{o}C and 80-85% RH).

Concerning the effect of some sprouting inhibitor and plant extracts i. e. succinic acid, salicylic acid, eucalyptus oil and peppermint oil on starch and sugar contents in potato tubers at the end of storage period (120 days), results in Tables (9 and 10)reveal clearly that the lowest value of starch content 7.63%and 9.07% in the first and second season respectively, in the tubers of control treatment, while the highest starch contents in tubers was obtained when potato plants treated with salicylic acid and eucalyptus oil . On the other hand, the lowest values of reducing, non-reducing and total sugar content in potato tubers at the end of storage period were obtained with treating potato by eucalyptus oil. Generally, it could be concluded that the treating potato plants (foliar sprays or soaking tubers)with succinic acid, salicylic acid, eucalyptus oil and peppermint oil gave the highest starch content and the lowest sugar contents in tubers during cold storage condition. Also, it could be indicate that there are insignificant differences among the treatments were shown in the two growing seasons.

Obtained results are in agreement with those obtained by Rojo (2011) who indicated that sprayed potato plants with salicylic acid reduced sugars contents in tubers and improvised tuber quality. AL-Zubaidy (2002) revealed that as the degree of low-temperature storage may led to the accumulation of reducing sugars and sucrose in the tubers as a result of the transformation of starch and enzyme activity by α-amylase under cold conditions. May decline was attributable percentage of dry matter and starch content in tubers at the end of a period of adjustment to stimulate the tubers to sprouting, and this leads to drain part of the dry matter stored in the tubers as well as the possibility of more rapid breathing as a result of the increasing growth of buds speed and consistent these results together with the results of Abdul Rasul (1996) who observed a decrease in the percentage of dry matter as a result of stimulating tuber sprouting as noted by Bailey *et al.* (1978), increasing the activity of the enzyme amylase when tubers sprouting which works to convert starch into sugars reductase to convey the bud in growth began and thus decreases the percentage of starch. Rassaeifarl *et al.* (2013)point out that essential oil of eucalyptus decreased respiratory activity. Kolupaev *et al.* (2011) suggested that the influence of exogenous succinic acid and salicylic acid in converted starch to sugars may be due to the influence of succinic acid and salicylic acid on the activity of antioxidant enzymes. Frazeir *et al.* (2004) peppermint and spearmint oils applied on potatoes during storage inhibit sprouting of tubers. Sprouting is associated with the conversion of starch to sugars. Thus, if

proper sprout control by repeated application of peppermint oil are necessary for adequate long term sprout control and reduced the conversion rate of starch to sugars, which is undesirable in the processing industry due to darkling of fried products.

Table (9): The changes of starch and sugar contents in potato tubers as affected with foliar sprays or soaking tubers by Succinic acid, Salicylic acid, Eucalyptus oil and Peppermint oil at the end of storage period (120 days) in 2012 summer seasons.

		First season(2012)			
Characters / Treatment (A) (B)		Starch (%)	Reducing sugars%	Non reducing sugars%	Total sugars%
Foliar Spraying	Control	7.63	0.171	0.712	0.883
	Succinic acid	10.14	0.143	0.606	0.749
	Salicylic acid	9.55	0.150	0.658	0.808
	Eucalyptus oil	9.44	0.136	0.544	0.680
	Peppermint oil	10.64	0.130	0.515	0.645
	Means	9.48	0.146	0.607	0.753
Soaking tubers	Control	7.63	0.174	0.700	0.874
	Succinic acid	11.15	0.139	0.555	0.694
	Salicylic acid	10.60	0.149	0.565	0.714
	Eucalyptus oil	10.48	0.135	0.504	0.639
	Peppermint oil	11.05	0.130	0.468	0.598
	Means	10.18	0.145	0.558	0.704
average (AB)	Control	7.63	0.173	0.706	0.879
	Succinic acid	11.15	0.141	0.581	0.722
	Salicylic acid	10.60	0.150	0.612	0.761
	Eucalyptus oil	10.48	0.136	0.524	0.660
	Peppermint oil	11.05	0.130	0.492	0.622
L.S.D.5% (A)		0.63	N.S	0.009	0.011
L.S.D.5% (B)		0.45	0.018	0.022	0.038
L.S.D.5% (AB)		1.18	0.033	0.038	0.051

Table (10): The changes of starch and sugar contents in potato tubers as affected with foliar sprays or soaking tubers by Succinic acid, Salicylic acid, Eucalyptus oil and Peppermint oil at the end of storage period (120 days) in 2013 summer seasons.

		Second season(2013)			
Characters / Treatment (A) (B)		Starch (%)	Reducing sugars%	Non reducing sugars%	Total sugars%
Foliar Spraying	Control	9.07	0.167	0.863	1.03
	Succinic acid	11.84	0.139	0.574	0.713
	Salicylic acid	10.82	0.145	0.72	0.865
	Eucalyptus oil	10.94	0.135	0.528	0.663
	Peppermint oil	11.88	0.122	0.473	0.595
	Means	10.91	0.142	0.632	0.773
Soaking tubers	Control	9.07	0.170	0.740	0.910
	Succinic acid	12.85	0.135	0.523	0.658
	Salicylic acid	11.87	0.144	0.654	0.798
	Eucalyptus oil	11.99	0.132	0.490	0.622
	Peppermint oil	12.38	0.122	0.426	0.548
	Means	11.63	0.141	0.567	0.707
average (AB)	Control	9.07	0.169	0.802	0.970
	Succinic acid	12.35	0.137	0.549	0.686
	Salicylic acid	11.35	0.145	0.687	0.832
	Eucalyptus oil	11.47	0.134	0.509	0.643
	Peppermint oil	12.13	0.122	0.450	0.572
L.S.D.5% (A) L.S.D.5% (B) L.S.D.5% (AB)		0.41 0.28 0.87	N.S 0.020 0.035	0.013 0.025 0.040	0.018 0.056 0.077

2.4. Plant emergence percentage.

As shown in Tables (11 and 12) show that from 18 to 41 days after planting, the percentage of plant emergence gradually increased with increasing the periods after planting. Also, the obtained results indicated that the percentage of plants emergence highly significant differences due to the treatments. The untreated (control) potatoes produced the highest percentage of plant emergence at all the periods of emergency. Data at the same tables show that foliar sprays potato plants at 30 days before the harvest of summer seasons exerted the

lowest percentage of plant emergence after planting tubers seeds in the next winter seasons compared with those of soaked seeds before storage. Concerning the effect of succinic acid , salicylic acid , eucalyptus oils and peppermint oils on plant emergence percentage in the winter seasons, results presented in Tables show clearly that the untreated potatoes (control)was the fastest emergence after planting and gave the highest percentage of plant emergence at the end of emergence period (41days from planting). On the other hand, data recorded in Tables (10 and 11) revealed that foliar sprays potato plants at 30 days before harvest with succinic acid or eucalyptus oils gave the slowlest emergence and the highest emergence percentage at the end of emergence period (41days) when seed tubers planted in the next winter seasons(2012/2013 and 2013 /2014 winter seasons).In this regard, foliar spraying potato plants with peppermint oils and salicylic acid decreased the rate of plant emergence and the percentage of germination as compared with control at 41days after planting .

Table (11): Effect of foliar spraying plants or soaking tuber seeds with some sprouting inhibitor and plant extracts on Percentage of germination (at18, 21,24,27 ,30,33,36and 41 days after planting) (Nili yield) during the winter season of 2012/2013 .

		First season(2012/2013)								
Characters / Treatments (A) (B)		Percentage of germination								
		18	21	24	27	30	33	36	39	41
Foliar Spraying	Control	54.8	71.0	83.9	90.3	93.5	96.8	97.0	97.0	97.0
	Succinic acid	1.5	6.0	11.7	18.1	21.5	31.7	36.2	40.6	55.1
	Salicylic acid	2.9	7.7	15.1	19.2	22.8	36.7	49.1	58.1	62.6
	Eucalyptus oil	2.6	4.8	7.8	15.6	23.4	30.2	38.1	44.8	59.5
	Peppermint oil	3.7	7.5	12.6	25.2	31.5	36.6	45.5	50.5	56.8
	Means	12.4	17.9	23.7	28.6	32.3	39.1	44.1	48.1	54.8
Soaking tubers	Control	46.4	60.7	71.4	82.1	82.1	85.7	95.0	96.0	96.0
	Succinic acid	0.0	1.6	7.7	16.4	20.8	30.9	35.3	41.4	53.8
	Salicylic acid	1.2	2.7	5.4	19.6	21.8	27.3	33.1	41.3	58.6
	Eucalyptus oil	1.2	2.8	5.0	7.2	8.2	12.4	20.7	26.3	43.0
	Peppermint oil	1.4	3.7	5.5	8.8	22.4	28.6	39.8	47.1	56.9
	Means	9.8	13.6	17.9	25.1	26.6	31.3	36.8	41.0	50.3
average(AB)	Control	50.6	65.8	77.6	86.2	87.8	91.2	96.0	96.5	96.5
	Succinic acid	0.7	3.8	9.7	17.3	21.2	31.3	35.8	41.0	54.5
	Salicylic acid	2.1	5.2	10.3	19.4	22.3	32.0	41.1	49.7	60.6
	Eucalyptus oil	1.9	3.8	6.4	11.4	15.8	21.3	29.4	35.6	51.2
	Peppermint oil	2.6	5.6	9.1	17.0	27.0	32.6	42.6	48.8	56.9
L.S.D.5% (A)		1.4	1.2	1.0	0.5	0.9	0.8	0.7	0.6	0.5
L.S.D.5% (B)		0.2	1.6	1.4	1.2	1.1	1.0	.09	0.8	0.6
L.S.D.5% (AB)		1.1	2.1	2.3	3.1	3.2	4.1	2.8	2.5	1.9

Table (12): Effect of foliar spraying plants or soaking tuber seeds with some sprouting inhibitor and plant extracts on Percentage of germination (at18, 21,24,27 ,30,33,36and 41 days after planting) (Nili yield) during the winter season of 2013/2014 .

		Second season(2013/2014)								
Characters / Treatments (A) (B)		Percentage of germination								
		18	21	24	27	30	33	36	39	41
Foliar Spraying	Control	50.8	69.0	80.9	88.3	93.5	97.0	97.0	97.0	97.0
	Succinic acid	1.6	5.5	11.3	17.4	21.0	31.2	35.5	40.4	54.0
	Salicylic acid	2.9	7.2	14.5	21.0	25.6	42.4	49.1	61.6	64.7
	Eucalyptus oil	2.6	4.8	7.5	15.3	23.4	29.6	37.6	44.8	54.3
	Peppermint oil	3.8	7.6	12.6	25.2	31.4	36.4	45.4	50.5	57.2
	Means	11.6	17.3	22.8	28.4	32.7	40.0	57.64	58.9	65.44
Soaking tubers	Control	52.6	68.4	78.9	89.5	97.0	97.0	97.0	97.0	97.0
	Succinic acid	1.4	6.5	11.2	17.6	20.5	30.5	35.5	39.5	50.5
	Salicylic acid	2.2	6.9	13.4	20.9	24.9	40.6	45.6	52.6	53.6
	Eucalyptus oil	2.3	3.8	7.3	14.9	21.5	29.7	36.1	49.1	50.1
	Peppermint oil	3.1	7.1	12.4	25.4	31.9	36.0	45.0	50.0	57.0
	Means	11.7	17.1	22.2	28.6	32.8	39.6	42.8	57.6	61.64
average (AB)	Control	51.7	68.7	79.9	88.9	95.3	97.0	97.0	97.0	97.0
	Succinic acid	1.5	6.0	11.2	17.5	20.7	30.8	35.5	40.0	52.3
	Salicylic acid	2.6	7.0	13.9	21.0	25.2	41.5	47.4	57.1	59.2
	Eucalyptus oil	2.5	4.3	7.4	15.1	22.5	29.7	36.8	47.0	52.2
	Peppermint oil	3.4	7.3	12.5	25.3	31.7	36.2	45.2	50.3	57.1
L.S.D.5% (A) L.S.D.5% (B) L.S.D.5% (AB)		1.4 1.2 1.3	1.2 0.8 1.7	1.0 0.5 1.3	0.5 1.5 2.1	0.9 0.7 1.1	0.8 0.1 1.4	0.7 0.1 1.2	0.6 0.1 0.8	0.5 0.1 0.7

Emergence of tubers indicate a breakage of dormancy and consequently the commencement of other successive physiological processes, ending with the termination of apical dominance. By the end of the apical dominance the lateral buds usually start to come up gradually.

The cultured process tubers before and during period of storage of critical points as that of the process paths first negative when

the storage for consumer purposes as the sprouting leads to reduce the qualitative value of the tubers (Asgar and Asandhi, 1993). The second positive when the storage of seeds, especially those stored in June and intended to be planted in the autumn and the subsequent that are stimulated by the farming season and in line with number of main stems required per unit area. Thus, to increase efficiency in both tracks and so does not depend on the use of cold storage only to prevent or inhibit sprouting of tubers. A lot of researchers and those interested in the storage and production of potato tubers to treat many of the chemical compounds to achieve this, according to the need and vehicles to prevent the stimulus in commercial scale is Malic Hydrazide, (Smith, 1968). But it is a result of the adverse impact of these chemicals the environment and public health. Plant extracts and volatile oil such as eucalyptus oil and peppermint oil used in potatoes during storage to inhibited sprouting and keep tubers for long time (AL-Zubaidy,2002).

These results are in harmony with those obtained with Rassaeifarl *et al,* 2013) who suggested that the eucalyptus globulus' essential oils effect on germination and seedling establishment. Germination percentage and germination rate decreased significantly under the effect of essential oil of *zea mays* and *Raphanus sativus*. The extracted essential oils inhibits germination and growth of the eyes of potato by killing meristem cells(Vaughn,1991). Also, Rassaeifarl *et al.* (2013) show that eucalyptus' essential oils significantly decreases the length of primary root, pedicle and seeding hight. Batish *et al.* (2004) reported the eucalyptus oil reduced the respiratory activities of plant can be the evidence of reduction in germination and growth. However, peppermint and spearmint oils applied in storage potato tubers can be used as effective sprout suppressants .

Regarding the effect of salicylic acid on the sprout and emergence of potato tubers, Ashgan Nassef (1989)show that treating potato plants with salicylic acid inhibited the sprout of tubers and decreased emergence rate. In addition, be menotined that salicylic acid was reported to be a phenolic inhibitor.

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تأثير مثبطات التزريع على محصول البطاطس وجودة الدرنات والقدرة التخزينية والتنبيت

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الملخص العربي

اجريت هذه التجربة لدراسة تأثير بعض منظمات النمو(سكسينيك اسد وسلسليك أسد وزيت الكافور وزيت النعناع تم إضافتها رشا على النبات بعد الزراعة 60، 70 و80 يوما) على المحصول وكذا القدرة التخزينية للصنف ديامونت وقد احتوت هذه التجربة على اربع معاملات اضافة الى الكونترول .

وفي كلا الموسمين نفذت التجربة باستخدام تصميم القطع الكامل العشوائية في ثلاثة مكررات زرعت الدرنات في بطن الخط وبلغ عرض الخط 70 سم والمسافة بين النبات والآخر 25سم وطول الخط 5 م وأجريت عمليات خدمة المحصول بحسب الطريقة المتبعة في مزرعة الكلية .وكانت النتائج المتحصل عليها هي:

محصول الدرنات:

أظهرت النتائج انخفاض معنوي في متوسط وزن الدرنة /نبات عند الرش بزيت النعناع بينما لم توثر بقية المعاملات معنويا على متوسط وزن الدرنة. أما بالنسبة لمحصول النبات والمحصول الكلي /فدان لم تظهر النتائج فروق معنوية في كلا الموسمين .وفي ما يتعلق بنسبة وزن الدرنات لم تظهر النتائج فروق معنوية في نسبة وزن الدرنات الصغيرة (اقل من 35ملليتر)بينما حدث انخفاض في نسبة وزن الدرنات الكبيرة (اكبر من 49ملليمتر)وزيادة في نسبة وزن الدرنات المتوسطة (36–49ملليمتر)، وتشير النتائج إلى أن زيت النعناع قد اعطت أقل القيم في نسبة وزن الدرنات الكبيرة وأعلى القيم في نسبة وزن الدرنات المتوسطة يليها زيت الكافور والسلسليك أسد والسكسنيك أسد وبفارق معنوي وذلك في موسمي الزراعة.

الكثافة النوعية ونسبة النشا ونسبة المادة الجافة في الدرنات :

تشير النتائج ان جميع المعاملات حققت زيادة معنوية في الكثافة النوعية ونسبة النشا ونسبة المادة الجافة مقارنة بالكونترول وان اعلى القيم للصفات المذكورة قد تحقق عند الرش بزيت النعناع يليه ،السلسليك اسد ، السكسنيك اسد وزيت الكافور على التوالي.

السكريات المختزلة والغير مختزلة والكلية في الدرنات قبل التخزين:

بينت النتائج أن جميع المعاملات ادت الى حدوث نقص معنوي في السكريات المختزلة والغير مختزلة والكلية وأن اقل القيم كان عند الرش بزيت النعناع يليها زيت الكافور، السكسنيك أسد والسلسليك أسد .

القدرة التخزينية:

أظهرت النتائج أن جميع المعاملات التي تم رشها قبل الحصاد على النباتات أدت الى زيادة عدد الايام اللازمة لبدء الانبات وخفض نسبة العيون النابتة /درنة واقل القيم لنسبة البراعم النابتة واقل القيم في نسبة الفقد في الوزن خلال فترة التخزين 120 يوما وبفارق معنوي مقارنة بالكونترول وتشير النتائج إلى أن أفضل المعاملات هي زيت الكافور يليه زيت النعناع يليه السكسنيك اسد والسلسليك أسد على التوالي.

كما أظهرت النتائج أن الدرنات التي تم نقعها بنفس المواد السابقة بعد الحصاد قد اثرت معنويا في الصفات المدروسة (عدد الايام اللازمة لبدء الانبات ، نسبة العيون النابتة /درنة ، نسبة البراعم النابتة ونسبة الفقد في الوزن) وقد أعطت معاملة زيت الكافور أعلى القيم بنسبة لعدد الايام اللازمة لبدء الانبات واقل القيم لنسبة لبراعم النابتة واقل القيم في نسبة الفقد في الوزن خلال فترة التخزين 120 يوما تليها معاملة زيت النعناع السكسنيك اسد والسلسليك أسد على التوالي.

من الواضح أن نقع الدرنات بزيت الكافور بعد الحصاد وقبل التخزين قد سجلت اعلى القيم لعدد الايام اللازمة لبدء الانبات واقل القيم لنسبة انبات البراعم واقل القيم لنسبة لبراعم النابتة واقل القيم في نسبة الفقد في الوزن خلال فترة التخزين 120 يوما مقارنة بالمعاملات المرشوشة قبل الحصاد.

وعموما أظهرت النتائج أن رش النباتات أو نقع الدرنات بعد الحصاد بالسكسنيك أسد ،السلسليك أسد، زيت الكافور وزيت النعناع أعطت أعلى محتوى من النشا وأقل محتوى من السكريات .

نسبة الانبات :

أظهرت النتائج أن النباتات التي تم رش نباتاتها في المحصول الصيفي بالسكسنيك أسد قد أعطت أقل نسبة إنبات يليها زيت النعناع ،زيت الكافور والسلسليك أسد هذا في الموسم الاول أما في الموسم الثاني فقد أعطت معاملة السكسنيك أسد أقل نسبة إنبات يليها زيت الكافور، زيت النعناع والسلسليك اسد .

أما الدرنات التي تم نقعها بعد الحصاد بنفس المواد السابقة فقد أعطت معامله زيت الكافور أقل نسبة انبات يليها السكسنيك اسد ،زيت النعناع والسلسليك أسد وذلك في كلا موسمي الزراعة.