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COMPARATIVE EFFECTS OF SOME POSTHARVEST TREATMENTS ON SPROUT SUPPRESSION OF STORED POTATO TUBERS AND SUSCEPTIBILITY FOR PROCESSING

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ABSTRACT

This study was conducted at Postharvest and Handling of Vegetable Crop Laboratories during 2006 and 2007 to study effect of different treatments, i.e., 250, 500 ppm CIPC, 75,150 ppm ethephon, 100, 200 ppm NAA, 1000, 2000 ppm methyl jasmonate, 2000, 4000 ppm lavender oil, hot water dipping at 52 ^{o}C for 30 min and 57 ^{o}C for 20 min as well as untreated control on Potato tubers cv. Diamant during storage for 120 days at 8 -10 ^{o}C and 85% relative humidity.

The objectives of the present investigation were to study the productivety of chips and French fry processing quality. The results showed that sprouting %, sprout length, weight loss, tuber dry matter % and specific gravity were increased with prolonging the storage period, while, tuber starch % was decreased with time during storage. Tuber of all tested treatments did not sprout until 30 days, and sprouting started after 60 days of storage. Treatments of CIPC at doses 250, 500 ppm and methyl jasmonate at 2000 ppm were the best in inhibting bud development and incidence of sprouting up to the end of storage period. The highest dry matter of the tubers was obtained by 100 ppm NAA and 4000 ppm lavender oil at the end of storage. Weight loss, specific gravity and starch % in the tubers during storage periods did not show any pronounced differences due to the used treatments. The highest significant chips weight after frying were from tubers of CIPC at 250, 500 ppm, ethephon at 75 ppm and untreated control. While, weight after frying (WAF) of French fries were the highest from tubers treated with 1000 ppm methyl jasmonate, 2000 ppm lavender oil and hot water at 57 ^{o}C for 20 min treatments during both seasons. The best chip color (light) was shown by 500 ppm CIPC, 150 ppm ethephon, 200 ppm NAA ,1000 ppm methyl jasmonate and hot water at 52 ^{o}C for 30 min while, the best color of French fries was shown by 75 ppm ethephon, 100, 200 ppm NAA, 2000 ppm methyl jasmonate in both seasons. lavender oil at 4000 ppm, hot water at 57 ^{o}C for 20 min and untreated (control) showed the best taste and crispiness in both years, while the best taste of French fries was shown by 250 , 500 ppm CIPC, 1000 and 2000 ppm of methyl jasmonate .

Keywords: Potatoes, Chlorpropham (CIPC), Ethephon, Naphthaleneacetic acid (NAA), Methyl jasmonate, Lavender oil, Hot water.

INTRODUCTION

Successful long-term storage of potatoes for processing and fresh market distribution needs sprout inhibitor in combination with proper storage mangement. Chlorpropham (CIPC), is a commonly used postharvest sprout inhibitor .CIPC is applied to bulk potatoes in storage as an aerosol at rates of 17 to 22 ppm at 10-12 ^{o}C. (Kleinkopf *et al*., 2003). Ashivmetha and Kaul (1991) found that CIPC was more effective in reducing physialogical losses, sprouting, and sprout growth in the cool than in the ambient store. Prange *et*

al. (1998) suggested that intermitent ethylene treatment may promote potato sprouting whereas continuous ethylene suppresses sprout growth. Prange *et al.* (2005) found that sprout growth was controlled by continuous ethylene supply and ethylene treatment enhanced fry color darkening. Suttle (2003) reported that an application of α – naphthalene acetic acid (NAA) to Russet Burbank minitubers induces endogenous ethylene production and inhibits sprout growth.

Lulai *et al*. (1995) were granted a patent for the use of jasmonates to control sprouting in stored potato tubers, however, dip treatment into methyl jasmonate emulsion at concentration of 0.001 to 0.01 mM delayed the onest of sprout growth of recently harvested "Norchip" potatoes approximately equal to that of CIPC. Additionally, some improvment of chip color is claimed. Jasmonates are naturally occurring plant bio-regulators that affect ripening and senescence processes including growth (Creedman and Mullet, 1997). Dipping topped radishes in solution of methyl jasmante (10^{-3} and 10^{-4} M) reduced sprout and root growth at 15 ^{o}C (Wang, 1998).

Ranganna *et al.* (1998) indicated that potato tubers can be safety stored for 12 weeks at either 8 or 18 ^{o}C without sprouting if tubers were dipped at 57.5 ^{o}C hot water bath for 20-30 min. Thermal treatment may be a viable alternative to chemicals for disease control (Perombelon *et al.,* 1989; Wills *et al.,* 1989) and could be also used to inhibit sprouting (Hide, 1975). Vokou *et al.* (1993) indicated that sprout suppressant properties of the essential oils of lavender, mint, spearmint, rosemary and sage were assessed. All the essential oils suppressed potato sprout growth.

Potato processing requires a contstant supply of specific cultivars that have good external quality, higher dry matter content and acceptable fry color (Hesen, 1981). Moreover, storage at low temperature (< 6 ^{o}C) and tuber aging increase the amount of reducing sugars in tubers (Van der Plas, 1987). Pritchard and Adam (1994) showed, also, that storage of potato at low temperature, will accumulate reducing sugars, primarily glucose and fructose.

The purpose of this study was to evaluate the effect of some ormatic volatile oils,CIPC, NAA, ethephon and hot water for suppression sprout in potatoes tuber and susceptibility for processing .

MATERIALS AND METHODS

Filed experiments were carried out in the two summers seasons of 2006 and 2007 at Abou Awad village, Aga, Dakahlia Governorate, Egypt, on potato (*Salonum tuberosum* L.) cv. Diamant. Seed pieces (50 g) were planted in January 15 and 19 and harvested in 16 and 20 May (120 days after planting dates) in both seasons respestively. All agricultural pratices were applied according to the Ministry of Agriculture recommendations.

The harvested tubers were kept on the field for 15-days to allow them to cure. Samples of sound tubers with the uniform size (45-55 mm) were transferred to the Postharvest and Handling of Vegetable Crop Department, Horticultural Research Institute. ARC, at Giza Governorate, for storage and processing experiments. The following treatments were used :

1- Chlorpropham (CIPC) at doses of 250 and 500 ppm.
2- Ethephon at doses of 75 and 150 ppm.
3- Naphthalene acetic acid (NAA) at doses of 100 and 200 ppm.
4- Methyl jasmonate oil at doses of 1000 and 2000 ppm.
5 - Lavender oil at doses of 2000 and 4000 ppm.
6 - Hot water dipping at (52 ^{o}C for 30 min and 57 ^{o}C for 20 min).
7- Untreated (control).

The thirteen treatments were distributed in a completely randomized design with three replications. Tubers were placed in cold storage at 8- 10 ^{o}C and 85% R.H.

Eessential oils as lavander and methl jasmonate were emulsified by tween 20 at dose 1 ml/l. All used sprout suppressions were spray as fog over the tubers for three times, i.e., at the beginning of storage and after 40 and 80 days of storage .

A total of 60 potato tubers per treatment were divided into three replications of 20 tuber each. Another 24 tubers of the same treatment, were placed loose in plastic boxes (40 x 30x10 cm) and stored up to 120 days. Measurments were made every 30 days to determine weight loss, sprouting percentage and maximum sprout length.

Six tubers were selected from each treatment to determine dry matter, starch content, specific gravity and reducing sugar.Dry matter content was determined by drying duplicate 100 g samples of flesh tissue at 70 ^{o}C for 72 hours in a forced air oven. Starch percentage was calculated by the following formula:

Starch % = 17.55 + 0.891 (dry matter % - 24.182) (Burton, 1948).

Potato peocessing quality.

Three tubers of 45-60 mm in diameter were used to determine chips (crisp) and French fry quality. Potato slices were prepared as reported by Lulai and Orr (1980) and fried at 180 ^{o}C heated sunflower oil for 3 minutes. After being peeled and trimmed, tubers for French fries were cut into 6 mm strips with 30 mm and length and were fried at 170 ^{o}C fried sunflower oil for 6 minutes. Weight after drying were recorded for both chips and French fries. Fried samples of chips were evaluated on a colour scale of 1 (very dark) to 9 (very light) using the Netherlands colour charts. Colour of French fry samples were evaluated on a color scale of 1 (very light) to 6 (very dark). A laboratory panel of 10 judges selected from staff of the potato research department evaluated the sensory qualities (color, taste and crispiness) of chips and French fries.

The data were statistically analyzed and means were compared by using Duncans multipe range test as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSIONS

Sprouting percentage

It is clear from the data illustrated in Figs (1,2,3 and 4) that sprouting of tuber appeared after 60 days of storage except CIPC at doses of 250, 500 ppm and methyl jasmonate at 2000 ppm in the first and second season as well as ethephon at 150 ppm in the second season.

f1

f2

f3

f4

The percentage of sprouted tubers was increased thereafter but at different rates for the various storage treatment. Untreated control showed the highest rate, whereas CIPC at 500 ppm had the lowest sprouting percentage. These trends were similar in both seasons, At the end of the storage period untreated (control) tubers reached almost complete sprouting (97.67% and 89.00% in both seasons respectively).

On the other hand, the CIPC at 250 and 500 ppm showed 5.00 % and 2.49 % in 2006 and 1.93% and 4.00% sprouting in 2007 season, respectively in (Table 1).The effect of CIPC on inhibition of sprouting may be due to CIPC inhibits develoment by interferring with cell division through interrupting the spindle formation during active mitosis (Vaughn and Lehnen, 1991; Kleinkoph *et al., 2003).*

Table 1. Effect of some postharvest treatments on sprouting, sprout length, weight loss, specific gravity, dry matter (%) and starch content of Potato tuber in 2006 and 2007 at 120 days after storage.

Parameters Treatments Doses in ppm	Sprouting (%)	Sprout length (cm)	Weight loss (%)	Specific gravity	Dry matter (%)	Starch (g/ 100g.dw.)
	20006 Season					
CIPC 250	5.00gh	0.303f	3.386cd	1.0955bc	27.577bc	18.26cf
CIPC 500	2.497h	0.2067f	3.107a	1.096ab	27.870ab	18.41def
Ethephon 75	14.00ef	1.800cd	3.672bcd	1.095bc	27.260bc	18.98bcde
Ethephon 150	12.00f	1.750cde	4.301ab	1.094bc	27.683bc	19.24abc
NAA 100	8.50egh	1.357de	3.860abcd	1.094bc	28.997a	19.93a
NAA 200	54.733b	3.150a	4.251ab	1.096ab	27.863ab	19.78ab
Methyl jasmonat 1000	9.500fg	1.417e	3.898abc	1.091c	26.432c	18.29ef
Methyljasmonate.2000	8.900fg	1.143e	3.549bcd	1.097ab	27.830ab	18.88cbf
Lavender 2000	47.007c	2.483b	4.112abc	1.095bc	27.960bc	18.39def
Lavender 4000	10.500fc	1.680cde	3.820abcd	1.099a	28.993a	19.61abc
Hot water 52 ^{o}C 2 min	33.000d	2.133bc	3.972abc	1.096abc	27.643bc	17.91f
Hot water 57^{o}C 3 min	19.3000e	1.900bcd	4.042abc	1.097ab	27.875ab	18.15ef
Control	97.670a	3.750a	4.453a	1.094bc	27.307bc	18.44def
	2007 Season					
CIPC 250	4.000hi	0.333f	4.277bc	1.091b	26.287ab	18.060ab
CIPC 500	1.927i	0.467f	3.663c	1.086b	25.210bc	17.570bc
Ethephon 75	12.320ef	1.907cdf	5.570ab	1.088bcd	25.727abc	16.587cd
Ethephon 150	10.680fg	1.827cde	5.383ab	1.090bcd	25.323abc	16.727cd
NAA 100	7.450fghi	1.500de	5.327abc	1.099bc	25.007bc	17.407bcd
NAA 200	46.400b	3.520a	6.540a	1.088a	25.537bc	18.927a
Methyljasmonate1000	8.700fgh	1.657cdb	4.403bc	1.097cd	25.437abc	16.657cd
Methyljasmonate 2000	6.500ghi	1.233e	5.140abc	1.097a	25.963abc	17.547bc
Lavender 2000	33.037c	2.733b	6.200a	1.097a	27.113abc	16.463cd
Lavender 4000	9.500fgh	1.740cde	5.470ab	1.099a	26.197ab	18.163ab
Hot water 52 ^{o}C 2 min	25.00d	2.267bc	5.570ab	1.099a	24.240c	17.497bcd
Hot water57 ^{o}C 3 min	16.850e	2.000cd	6.410a	1.098a	24.717bc	16.393d
Control	88.997a	4.167a	4.940abc	1.097a	25.067bc	17.073bcd

***Means followed by the same letter within each column do not significantly Duncans Multiple Range test at the level of 5%.**

Sprout length

Concerning the average sprout length, data presented in Figs (1,2,3,4) and Table (1) showed the effect of different posthrvest treatments as sprout suppressions applied to Diamant tubers during different storage period in the two seasons of study. Obviously all treatments did not show any sprout growth until 30 days of storage. In 2006, and after 60 days of storage, CIPC at concentrations 250, 500 ppm, methyl jasmonate at 2000 ppm and ethephon at 150 ppm in 2007 showed no sprouting. However, sprout length reached 1.1 and 1.24 cm for untreated control in 2006 and 2007 seasons, respectively.

After 120 days of storage, statistical analysis showed that the differences were significant in both seasons. However, sprout length reached 3.75 and 4.17 cm for untreated and 3.15 and 3.52 cm for NAA at 200 ppm in the first and second seasons, respectively, whereas the sprout length due to methyl jasmonate at dose of 2000 ppm reached 1.14 and 1.23 cm in both seasons, respectively. Generally, the differences among the treatments in sprout length persisted till the end of the storage period in both years. Essential oil basic component as methyl jasmonate found to be completely inhihited 3 hydroxy -3- methylglutrayl caenzyme A reductase (HMGR, the key enzyme of mevalonate pathway in potato tubers, at low concentration, which mevalonate known to be the main pathway of gibberellin biosynthesis. Lulai *et al.* (1995) found similar results using jasmonates.

Weight loss percentage

Data illustrated in Figs (1,2and3) showed that there was a posistive relationship between storage period and weight loss percentage of tubers. Prolonging the storage period increased tuber weight loss percentage, during the two seasons Fig (4). Similar trend was obtained by Fayad (1978) and Tawfik (1984). The same data cleared that, after 120 days of storage, untrated control and NAA at 200 ppm in the first season, NAA at 200 ppm and hot water treatment at (57 ^{o}C for 20 min) in the second season showed higher weight losses than CIPC at a dose of 500 ppm, however, these differences did not reach the significant level.

Dry matter percentage

Results given in Figs (1,2 and3) indicated that the dry matter percentage of tubers was increased when increasing the period storage from 30 to 120 days (Fig 4). It is clear from Figs (1,2,3and 4) that dry matter content of tubers was increased by all treaments in both seasons. However, the differences did not reach the significant level among the postharvest treatments used until 90 days, in both seasons. The results in Table (1), also, indicated that there were significant differences among the postharvest treatments during storage period in both seasons of the study. However, the results in Table (1) indicated that the highest value of dry matter percentage was recorded due to using lavender oil at the cocentration of 4000 ppm, hot water at 57 ^{o}C for 30 min, methyl jasmonate at 2000 ppm, NAA 100, 200 ppm and CIPC 500 ppm. The lowest significant value of dry matter was shown due to applying of methyl jasmonate at a dose of 1000 ppm in the first season and hot water at 52 ^{o}C for 30 min.and 57 ^{o}C for 20 min in the second season in (Fig 4 and Table 1). It was known that the lavender oil and/ or their basic

constituents slow down the activity of most enzymatic reaction, especially those related with tuber carbohydrate reserves are degraded to sugars and respiration as well as energy metabolism (Vokou *et al.,*1993; Tullis and grave, 2006).

Starch percentage

Data presented in Figs (1,2 and 3) demonstrated that Diamant tuber starch content was affected by storage periods. The results, clearly, indicated that tuber starch content decreased via prolonging the storage period, in the two seasons (Fig 4). This result could be attriluted to the hydrolysis of starch during storage period. Concerning the effect of posharvest treatments on starch percentage, the results in Figs (1,2 and 3) did not show any pronounced effect.

Starch percentage as affected with potharvest treatments are presented in Table (1). The results showed that application of ethephon at concentratios 75, 150 ppm, NAA at 200 ppm and lavender oil 4000 ppm induced the highest level of starch content in both seasons, While, the lowest levels of starch content were observed with hot water at 52 ^{o}C for 30 min in the first season and 57 ^{o}C for 20 min in the second season. The effect of NAA on strach percentage during storage of potato tubers could be logically true. Since increase in starch content could be due to reducing the sprouting and weight loss of tubers as well as low carbohydrate changes within tuber tissues as reported by Lowis *et al.* (1997) and Suttle (2003).

Specific gravity

Data illustrated in Figs (1,2 and 3) showed that there was a positive relationship between the storage period and the specific gravity of tubers. It was clear from Fig (4) that the differences among all postharvest treatments through the storage period, did not reach to the significant level. Morover, the data showed that the highest specific gravity was obtained after 120 days of storage.

The highest specific gravity values were obtained after treatments with doses of 500 ppm CIPC, 200 ppm NAA , methyl jasmonate at 2000 ppm, lavender oil at 4000 ppm, hot water at 52 ^{o}C for 30 min and 57 ^{o}C for 20 min in both years. While, the lowest specific gravity values were obtained by CIPC at 250 ppm, 75 and 150 ppm of ethephon, NAA at 100 ppm in the two seasons and lavender oil at 2000 ppm in the frist season in (Table 1). These resuls are in agreement with those reported by Kleinkopf *et al.*(1997) and Ashivmetha and Kaul (1997).

Weight after frying

During 2006, chips weight after frying (WAF) of the untreated control was approximately equal to CIPC at doses of 250, 500 ppm CIPC and ethephon at 75 ppm (Table 2).

In 2007, the untreated control, was significantly superior to CIPC at 250, 500 ppm and ethephon 75 ppm. Hot water at 52 ^{o}C for 30 min treatment showed the lowest values of chips WAF during both seasons (Table 2).It was clear, also, from Table (2) that after 120 days of storage, methy jasmonate at a dose of 1000 ppm, lavender oil at 2000 ppm and hot water at 57 ^{o}C for 20 min produced the highest WAF of Fench fries, in both seasons. Simllar results are in accordance with those reported by Oberg and Kleinkoph

(2000). On the other hand, methyl jasmonate at a dose of 2000 ppm produced the lowest WAF of French fries during 2006 and 2007 seasons.

Sensory quality tests

In 2006 and 2007 seasons, the best chip color (light) was noticed with used CIPC at concentration 500 ppm, ethephon at 150 ppm, NAA at 200 ppm, methyl jasmonate at 1000 ppm, lavender oil 2000 ppm and hot water at 52 ^{o}C for 30 min. However, the relatively dark color was obsorved with used NAA at 100 ppm (Table 2). As regard to taste and crispness, lavender oil at a dose of 4000 ppm and the control gave the best taste in both season. While, CIPC at a dose of 500 ppm, ethephon at 150 ppm, lavender oil at a dose of 4000 ppm and hot water at 52 ^{o}C for 30 min in the first season and ethephon at a dose of 150 ppm, lavender oil at a dose of 4000 ppm, hot water at 52 ^{o}C for 30 min,CIPC at a doses 250 and 500 ppm in the second season gave the best crispness.

Table 2. Effect of some posharvest treatments on weight after frying and sensory culinary quality of chips and French fries of potato tuber in 2006 and 2007 at 120 after days storage.

Parameters	Chips				French fries		
	2006 Season						
Treatments Doses in ppm	WAF (g)	Color (1-9)	Taste (1-5)	Crisp (1-5)	WAF (g)	Color (1-9)	Taste (1-5)
CIPC 250	44.33a	8.167b	3.83ef	4.83a	43.00c	2.5bc	4.00a
CIPC 500	44.33a	9.00a	4.33cd	5.00a	42.667cd	2.5bc	4.00a
Ethephon 75	43.50a	7.167c	4.00def	3.167g	41.00ef	2.00bc	3.50b
Ethephon 150	41.43b	9.00a	4.167cde	5.00a	41.167def	3.00ab	3.33d
NAA 100	36.67d	6.67de	2.83gh	3.83de	39.667fg	2.00c	3.50b
NAA 200	41.00b	9.00a	3.67f	4.00cd	40.833ef	2.00c	3.50b
Methyl jasmonate 1000	41.33b	9.00a	3.167g	3.167g	47.167a	3.50a	4.00a
Methyl jasmonate 2000	32.67e	7.00cd	2.667h	3.67ef	32.00h	2.00c	4.00a
Lavender 2000	38.80c	8.83a	4.167cde	3.50f	47.500a	3.50a	2.50g
Lavender 4000	33.40e	6.50e	5.00a	5.00a	41.167cdf	2.50bc	3.00f
Hot water 52 ^{o}C 20 min	30.83f	9.00a	4.50bc	4.80a	45.33b	3.00ab	3.20e
Hot water 57 ^{o}C 30 min	33.67e	8.00b	4.83ab	4.50b	46.33ab	3.50a	3.40c
Control	45.00a	7.83b	5.00a	4.167c	38.50g	2.00c	4.00a
2007 Season							
CIPC 250	43.67b	8.50bc	3.83de	4.93a	40.50d	2.50d	3.97a
CIPC 500	44.50b	8.83ab	4.50bc	4.83ab	42.00c	3.00c	3.77ab
Ethephon 75	44.00b	7.33de	4.17cd	3.17e	40.50d	2.17e	3.33bc
Ethephon 150	41.33c	8.83ab	4.00d	5.00a	41.66cd	3.00c	3.33c
NAA 100	36.33e	7.00e	2.85fg	4.17c	37.17e	2.40d	3.50bc
NAA 200	41.00cd	9.00a	3.50e	4.17c	40.67d	2.00e	3.33c
Methyl jasmonate 1000	40.33d	9.00a	3.00f	3.33de	46.17a	3.83a	4.00a
Methyl jasmonate 2000	31.00g	7.56d	2.50g	3.66d	33.33f	2.00e	4.07a
Lavender 2000	36.00e	9.00a	4.17cd	3.50de	46.50a	3.43b	2.50e
Lavender 4000	30.33gh	6.17f	5.00a	5.00a	41.50cd	2.50d	3.00d
Hot water 52 ^{o}C 20 min	30.00h	9.00a	4.00d	5.00a	44.67b	3.00c	3.50bc
Hot water 57 ^{o}C 30 min	35.00f	8.33c	4.83ab	4.50bc	46.67a	3.50b	3.50bc
Control	46.56a	8.17c	5.00a	4.17c	37.83e	2.00e	3.63bc

***Means followed by the same letter within each column do not significantly differed using Duncans Multiple Range Test at the level of 5%.**
WAF = weight after frying .

The best color of French fries was obsorved with ethephon at concentration 75 ppm, NAA at a doses 100, 200 ppm and metyl jasmonate at 2000 ppm in the two seasons. Whereas, metyl jasmonate at 1000 ppm, lavender oil 2000 ppm and hot water at 57 ^{o}C for 20 min gave darker strips. Ethephon at 150 ppm and hot water 52 ^{o}C for 30 min recorded that intermdiate acceptable color of Fraench fries (Table 2). The dark color associated with chip frying could be a result of the browing reaction or Millard reaction (Smith, 1968).

Conclusion

It could be concluted that the used ormatic volatile oils suppressed the sprouting and improved the quality of the processed potato tubers.

REFERENCES

Ashivmehta, S.A. and H.N. Kaul (1991). Effect of sprout inhibitors on potato tubers (*Solanum tuberosum* L.) stored at ambient or reduced temperatures. Potato Research 34: 443-450.

Burton, W.G. (1948). The Potato. Chapman and Hall, London, P. 319.

Creedman, R.A. and J.E. Mullet (1997). Biosynthesis and action of jasmonates in plants. Annu. Rev. Plant Physiol. Mol. Biol. 48: 355-381.

Fayad, A.N.A. (1978). Physiological studies on the productivity and the keeping quality of some potato varieties. M.Sc. Thesis, Fac. Agric. Monofiya Univ., Egypt.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for Agriculture Research. John Wiley and Sons Inc., New York.

Hesen, J. (1981). The potato as a new material for the food industry. In : International potato Course, Wageningen (ed.).International Agricultural Center, Wageningen, the Netherlands, PP. 1-14.

Hide, G.A. (1975). Effect of hot treatment of potato tubers on oospora pustules. Plant Pathol. 24: 233-236.

Kleinkopf, G. E.; T.L. Brandt; M.J. Frazier and G. Moller (1997). CIPC residues on stored Russet Burbank potatoes: 1. Maximum label application. Amr. potato J. 74: 107-117.

Kleinkopf, G. E.; N.A. Oberg and N. L. Olsen (2003). Sprout inhibition in storage: Current status, New chemistries and natural compounds. Amer. J. Potato Res. 80:317-327.

Lewis, M.D.; G.E. Kleinkopf and K.K. Shetty (1997). Dimethylnaphthaslene and disopropylnaphthalene for sprout control in storage :1. Application methodology and efficacy. Am. Potato J. 74: 183-197.

Lulai, E.C. and P.H. Orr (1980).Quality testing facilities for grower use at the potato research loboratory. Am. Potato J. 57:622-628.

Lulai, E.; P.H. Orr and M.T. Glynn (1995). Natural suppression of sprouting in stored potatoes using jasmonates. U.S. Patent 5; 436, 226 issued 25 July.

Oberg, N.A. (2000). Effect of methyl jasmonate and anisic acid on stored potato tuber quality.M.S.Thesis. College of Agriculture, Univ., Idaho, Moscow, ID.

Perombelon, M.C.M.; E.M. Burnett; Meluin and J.S.; S. Black (1989). Preliminary studies on the control of potato blacking by a hot water treatment of seed tubers. In Tjamos, E.C. Beckman, C.H. (eds.) vascular wilt Diseases of plants Basic studies and control. NATO Advanced Science Institues Series,Springer- Verlag, New York. PP. 557-566.

Prange, R.K.; W.Kalt ; B.J.Daniels. Lake; C.L. Liew, R.T. Page; J.R. Walsh ; P.Dean, and R. Coffin (1998). Using ethylene as a sprout control agent in stored "Russet Burbank" Potatoes. J. Amr. Soc. Hort. Sci. 123: 463-469.

Prange, R.K.; J.Barbara; D.Lake; J.C. Jeong and M.Binns (2005). Effect of ethylene and 1-Methylcyclopropene on potato tuber sprout control and fry color. Amr.J. Potato Res. 82:123-128.

Pritchard, M.K. and L.R. Adam (1994). Relationships between fry color and sugar concentration in stored Russet Burbank and shepody potatoes. Amr. Potato J. 71:59-68.

Ranganna, B.; G.S.V. Raghavan; A.C. Kushlappa (1998). Hot water dipping to enhance storabilty of potatoes. Postharvest Biology and Technology, 13: 215-232.

Smith, O. and C.O. Davis (1968). Potato processing In: Potatoes: production, storing and processing. Smith, O. (Ed), pp. 558-602. the AVI Publishing Company, Inc., London, England.

Suttle, J.C. (2003). Auxin- induced sprout growth inhibition: Role of endogenous ethylene. Amer. J. Potato Res. 80:303-309.

Tawfik, A.A. (1984). Produclivity of locally produced seed potatoes as affected by storage conditions. M.Sc. Thesis, Faculty of Agric., Ain-Shams Univ, Cairo, Egypt.

Tullis, B.M. and O.K. Grove (2006). Brine shrimp tolerance to potato sprout inhibitors. The Oklahoma Junior Academy of Science., Feb. 21.

Van der Plas, L.H.W. (1987). Potato tuber storage: biochemical and physiological changes. In: Bajaj, Y.P.S. (Editor) Biotechnology in Agriculture and Forestry. Vol.3: Potato, springerverlog Berlin Heidelberg. PP. 190-198.

Vaughn , K. C. and L.P. Lehnen (1991). Mitotic disrupter herbicides. Weed Sci. 39: 450-457.

Vokou, D. (1993). Indicated that sprout suppressant properties of the essential oils of lavander, mint, spearmint, rosemary and sage were assessed. All the essential oils suppressed potato sprout growth. 26: 2253-2262.

Wang, C.Y. (1998). Methyl jasmonate inhibits postharvest sprouting and improves storage quality of raddishes. Postharvest Biol. Technol. 14:179-183.

Wills, R.B.H.; W.B.McGlasson; D. Graham; T.H. Lee; E.G. Hall (1989). Postharvest: An Introduction to the physiology and Handing of Fruit and Vegetables Aut. New York.

مقارنة تأثير بعض معاملات ما بعد الحصاد كمثبطات تزريع لدرنات البطاطس المخزنة و مدى قابليتها للتصنيع

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أجريت تجربتين تخزين فى معمل قسم بحوث تداول الخضر – معهد بحوث البساتين خلال موسمى 2006 و2007. وتم أختيار كل من كلوروبروفام عند تركيز 250 ، 500 جزء فى المليون – الايثيفون 75 ، 150 جزء فى المليون – ونفثالين إستيك أسيد 100 ، 200 جزء فى المليون – وزيت الياسمين 1000 ، 2000 جزء فى المليون – وزيت اللافندر 2000 ، 4000 جزء فى المليون – والماء الساخن على درجة 52 م° لمدة 30 دقيقة و 57 م° ولمدة 20 دقيقة – الكنترول بدون معاملة على صنف البطاطس دايمونت خلال فترة 120 يوم على درجة حرارة 8 - 10 م° و رطوبة نسبية عند 85 % لدراسة تأثير تلك المعاملات كمثبطات تزريع لدرنات البطاطس المخزنة و صفات جودة الدرنات التصنيعية من (شيبسى وأصابع محمرة) وكانت النتائج المتحصل عليها كما يلى:-

- زادت نسبة التنبيت وطول النبت والفقد فى الوزن والكثافة النوعية بزيادة طول فترة التخزين بينما قل محتوى الدرنات من النشا خلال فترة التخزين.
- جميع المعاملات التخزينية لم تظهر اى نبت حتى 30 يوم بينما بدأ التنبيت بعد 60 يوم من التخزين.
- الكلوروبروفام 250 ، 500 جزء فى المليون وزيت الياسمين 2000 جزء فى المليون قد أعطت أفضل المعاملات فى تثبط نمو البراعم حتى نهاية التخزين.
- أعلى محتوى من المادة الجافة فى الدرنات تم الحصول عليه بواسطة المعاملات نفثالين إستيك أسيد عند 100 جزء فى المليون وزيت اللافندر عند 4000 جزء فى المليون حتى نهاية فترة التخزين، بينما الفقد فى الوزن والكثافة النوعية ومحتوى الدرنات من النشا خلال فترة التخزين لم تظهر المعاملات التخزينية اى فروق معنوية بينهما.
- وجد أعلى معنوية فى صافى وزن بعد التحمير فى البطاطس الشيبسى مع المعاملة الكلوروبروفام 250 عند ، 500 جزء فى المليون والايثفيون 75 جزء فى المليون والكنترول بينما أعلى وزن بعد التحمير (فى الاصابع المحمرة) مع معاملة الدرنات بزيت الياسمين عند 1000 جزء فى المليون وزيت اللافندر عند 2000 جزء فى المليون والماء الساخن عند (57 درجة لمدة 20 ق) فى كلا الموسمين.
- أفضل لون للبطاطس الشيبسى تبين مع الكلوروبروفام عند تركيز 500 جزء فى المليون والايثفيون 150 جزء فى المليون ونفثالين إستيك أسيد 200 جزء فى المليون وزيت الياسمين 1000 جزء فى المليون والماء الساخن عند درجة 52 درجة لمدة 30 ق , بينما أفضل لون من الأصابع المحمرة ظهر مع الايثفيون عند 75 جزء فى المليون ونفثالين إستيك أسيد عند 100 و 200 جزء فى المليون وزيت الياسمين عند 2000 جزء فى المليون والماء الساخن عند (57 درجة لمدة 20 ق) فى كل من الموسمين.
- أوضحت معاملة الدرنات بزيت اللافندرعند 4000 جزء فى المليون والماء الساخن (57 درجة لمدة 20 ق) والكنترول أفضل طعم للبطاطس الشبيسى خلال الموسمين. فى حين أظهر كل من الكلوروبروفام عند تركيز 250 ، 500 جزء فى المليون وزيت الياسمين 1000و2000 جزء فى المليون أفضل النتائج بخصوص فى الأصابع المحمرة .