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PESTICIDES RESIDUES IN TOMATOES, POTATOES AND VINE LEAVES

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ABSTRACT

The efficiencies of washing, preparing and cooking as well as time after pesticide spraying in the elimination of some pesticides residues from the treated vegetable were studied. The results indicated some variations in the different used pesticides and treated vegetables. Higher deposits were detected for the use of malathion, pirimiphos-methyl and formothion in vine leaves indicating the relation between the treated surfaces and residues deposits.

`The highest levels of residues were found in vine leaves, while the lowest values were noticed in tomato fruits. The reduction percentages of the used pesticides in tomatoes and vine leaves attained the highest values during the first twenty four hours and tended to decline afterwards. In spite of the high deposits in vine leaves after one hour post spraying, residues of pirimiphos-methyl showed the highest reduction rates, followed by formothion+dimethoate and lately came malathion within the first 24 hours. The reduction percentage of chlorpyrifos-methyl was also slightly higher than profenofos that of in tomatoes after one day of application. The residues of pesticides continued to decrease with the passage time after treatment as the used pesticide residues in all materials (vine leaves, tomato fruits and potatoes) were greatly reduced by the prolongation of time. Carbaryl residues of potatoes in tuber pit persisted relatively long time. The slow rate carbaryl degradation was related to the normal condition of tuber pit and not to its stability. The residue half life values were 23 and 21 hours for chlorpyrifos-methyl and profenofos in tomato fruits, respectively. While these values were 17, 13 and 16 hours for malathion, pirimiphos-methyl and formothion+ dimethoate in vine leaves in respective order. This value was 140 for carbaryl in potatoes in tuber pit condition. Tomatoes could be marketed after 3 days when treated with chlorpyrifos-methyl and 10 days in case of profenofos spraying. Vine leaves could be marketed after 6 days post malathion or pirimiphos-methyl but 10 days following formothion application. Carbaryl used for dusting should not be recommended for human consumption but only for protection potatoes for the new season cultivation.

Washing was efficient in partial elimination of the pesticide residues from tomatoes and vine leaves after one day post application. Thoroughly washing of potatoes treated with carbaryl removed most of the initial residues deposit after one hour post treatment.

Boiling vine leaves and concentrating tomato juice for making tomato paste resulted in complete elimination of the used pesticide residues on the third day after spraying. Cooking either by boiling or frying and/or combined with washing and peeling totally removed carbaryl residues from the dusted potatoes even at the initial time.

INTRODUCTION

Pesticides included natural and artificial substances such as insecticides, herbicides, fungicides, disinfectants and rodenticides. They are used to help control, destroy or repel destructive pests (Robison and Dahl, 1996). The amounts of synthetic pesticides residues in plant foods are insignificant compared to the amount of natural pesticides produced by plants themselves (National Center for Policy Analysis, 1998).

`In the USA, nearly 10% of the approximately three billion kg of toxic chemicals released per year is known to be carcinogenic (USBC, 1994). Public health risks associated with pesticides and natural toxins in foods. Consumers are very concerned about pesticide residues in food. Recent surreys of consumers have indicated that more than 80 percent view pesticide residues as "a serious hazard" (Bessin, 2001 and Pimentel, 1996). Children may also handle pesticides differently from adults. This may result in health risks from pesticides that are lower or higher than adults (Lopes, 1995).

Pesticides can be broadly divided into a number of groups which relates to their functionality and structure. Examples of some groups and pesticides within the groups are, organochlorine, organophosphorus, carbomate pesticides, synthetic pyrethroid insecticides and triazine herbicides (Rigg and Christen, 1996). Organophosphorus pesticides have a higher acute toxicity than organochlorines, but they have the advantage of being rapidly degraded in the environment. Organochlorine compounds have been banned but their residues still appear as pollutants in food as well as the environment (Rea, 1996). High level of pesticide residues was existed after washing and/or safety period (Kariem *et al.*, 1991; Ramadan *et al.*, 1992; Saleh *et al.*, 1993 and Lee, 2001).

Consumer concerns about minimizing health risks of pesticide residues in vegetables and fruits had been increasingly focused (Pesticides Residues Committee, PRC, 2000). Tomato products may contain significant residues (Benbrook, 1997). Potatoes were found to contain insecticide residues above the safety levels (PRC, 2002). Evidence from previous survey has shown that grapes can contain a relatively wide range of pesticide residues. This is due to the fact that grapes are susceptible to insect and fungal attack and as high value crops the look of the fruits is important PRC, (2002).

MATERIALS AND METHODS

1. Potato tubers

Potato tubers variety (Dimont) were cultivated at Giza Governorate. Samples were selected to be free from any pest infestation and were divided into two parts. First part was kept as control and other part was dusted with 10% sevine carbaryl at the rate 1.5Kg/ton. Samples were stored in polyethylene bags at –20°C until analysis. The analysis were done after one hour, 15, 40, 70 and 140 days after treatment.

- Five treatments were done
- Without processing
- Washing samples were washed by running tap water for 3minutes.
- Washing and boiling: Samples were washed by running tap water for 3 minutes, then blanched in boiling water at 100°C for 30 minutes, then cooled to room temperature.
- Washing and peeling: Samples were washed by running tap water for 3 minutes, then peeled with hand peeler where very thin layer (<1mm) was removed.
- Washing and frying: The washed tubers were chopped to small pieces and soaked for 5 minutes in tap water, then fried in corn oil at 200 °C, picked up on clean tissue paper to absorb the excess fried oil.

2. Tomato seedlings plants variety (Casel Raock) were separately sprayed with chlorpyrifos-methyl 50% EC and Profenofos 72% EC at the recommended rate of 1000 and 750 ml/feddan, respectively. Representative samples of tomato fruits were taken are hour after application. Subsequent samples were taken 1, 3, 6 and 10 days after treatment. Samples were kept in polyethylene bags at –20°C until analysis.

- Three treatments were carried out
- Without processing – unwashing.
- Washing: Samples were washed by running tap water for 3minutes

  Washing and concentrating: Tomtato samples were soaked and washed with running tap water for 3 minutes, then crushed using electric blender and seeds were removed by sieving. Tomato juice was heated with steam under vacuum until total soluble solids reached 25%. Samples were taken for analysis after one hour and one day after treatment.

3. Vine stems seedlings variety (King Ruby) were separately sprayed with Actellic 50% EC., Malathion 57% E.C. and Formathion 33% E.C. at the recommended rate of 150, 200 and 150 ml/100 litter water per feddan, respectively. After one hour as well as after 1, 3, 6 and 100 days after application.

- Processing of vine leaves samples two treatments were done. The first one was unwashed samples without any treatment. The other treatment (boiling) in tap water was done for 3 minutes, then leaves were drained.

METHODS

1. Extraction of carbaryl residues from potato tubers: The procedure of Laurance (1982) was followed.
2. Extraction of pesticide residues from tomato fruits and vine leaves: The procedure of Luke *et al.*, (1981) was followed.
3. Gas chromatographic determination: Quantitative analysis of organo-phosphorus pesticides were performed by Philips PU 4500. Chromatography equipped with flame photometric detector (FPD). A glass column, 6 feet × 4mm id, packed with 6% ov-210+4% SE-30 on 80-100 mesh chromasorb Q, column temperature 230°C, detector 240°C gas flow (ml/min) nitrogen, air and hydrogen 30.

4. High performance liquid chromatography (HPLC) was used for carbaryl quantitative determination. It was performed by LC_{18} (250×4.0 id) column attached with LDC. Analytical, Consta. Metric 3200 solvent delivery system equipped with Spectra Monitor 5000 photodiode array detector. Mixture of water acetonitrile (40:60) as mobile phase at the flow rate of one ml/minute and UV absorbency was 254 nm were used.

RESULTS AND DISCUSSION

The concentration of organophosphorus pesticide residues and the percentage of reduction after different times post spraying the tomato plants in unwashed, washed and cooked tomato fruits are illustrated Table (1). The results indicated that the levels of both pirimiphos methyl and profenofos on unwashed tomato fruits were greatly decreased to 0.561 and 0.387ppm, respectively after 24 hours as in the percentage of reduction exceeded 50%, being 52.3 and 58.3%, respectively. On the 3rd day after spraying the residues dropped till reached 0.280 and 0.124 ppm, respectively, indicating that the reduction percentages were 76.09 and 86.64%, respectively. Results also indicated that both pirimiphos-methyl and profenofos residues were greatly affected by the time intervals after application as after 6 days and the most of these residues were removed (about 98%) and after 10 days were totally eliminated.

Table (1): Effect of washing on the level of the organophosphorus pesticide residues and the percentage of reduction in tomato fruits and concentrated paste after different period post pesticide spraying.

Time after treatment (days)	Pirimiphos-methyl						Profenofos					
	Unwashed		Washed		Washed and cooked (concentrated paste)		Unwashed		Washed		Washed and cooked (concentrated paste)	
	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	*Reduction %*
Initial*	1.176	0.000	0.417	64.57	a	100	0.928	---	0.259	72.09	a	100
1	0.561	52.30	0.561	78.83	a	---	0.387	58.30	0.158	82.97	a	---
3	0.280	76.09	0.060	94.95	---	---	0.124	86.64	0.084	90.95	---	---
6	0.030	97.45	---	---	---	---	0.016	98.28	---	---	---	---
10	0.006	99.49	---	---	---	---	0.004	99.99	---	---	---	---

*** Sample were taken one hour after spraying**
a: Not detectable

Thus, it could be concluded that after 10 days of pesticides application, tomato fruits might contain negligible amounts (<0.5%) consequently, harvesting tomato after ten days of pesticides spraying could be recommended.

It is also obvious from Table (1) that 64.57 and 72.09% of pirimiphos-methyl and profenofos respectively were removed due to washing of tomato fruits after one hour post spraying tomato plants. The reduction percentage was proportionally increased with increasing the time after applying pesticides for tomato plants for washed tomato fruits.

On the six day after spraying tomato plants, pesticide residues were completely removed from washed tomato fruits.

It is worthy to mention that washing and cooking totally elimenated the residues from tomato paste even after one hour of applying pesticides for tomato plants as are shown in (Table 1).

In this respect, Kamil (1993) found that residues or rganophosphorus pesticide "dimethoate in tomato fruits were rapidly decreased as the time was increased after ten days post spraying. Abdel-Daim and Zidan (1996) found that washing partially removed profenofos residues from contaminated tomatoes, while cooking resulted in moderate removal of profenofos, but extracted and concentrated tomato juice for preparing tomato paste were free from pesticide residues.

The obtained results coincide with those of Zidan *et al.* (1997) who noted that washing process resulted in removal of the deposited insecticide residues (pirimiphos-methyl, malathion and fenitrothion) from tomato fruits.

Such findings are in agreement with those obtained by Ismail *et al.*, (1993) and Kamil (1993) who mentioned that the heat treatment of tomato juice was very effective on eliminating pesticide residues from tomato paste and concentrated juice.

The effect of storage as well as washing, peeling and cooking rocesses on the carbaryl residues of the dusted potatoes were studied. (Table 2) data showed that the initial deposits of the unwashed potatoes was 39.17 ppm. After 15 days of storage the infested dusted potatoes, the level of carbaryl residues did not markedly affected (decreased,), being 38.97. Afterwards, the residues gradually decreased during storage, indicating that the deposits were reduced by 7.50, 26.37 and 49.55% after 40, 70 and 140 days post treatment, respectively.

The carbaryl residues in potatoes were slowly decreased as the time of storage in tuber pit was increased. The level of carbaryl was still high even after 140 days as the reduction percentage was about one half of the initial amount.

Similar observation was reported by Hegazy *et al.* (1988) and Haggag (1994) who observed that simithion residues was gradually decreased during the three months storage of dusted potatoes by 3% simithion.

`The effect of washing on the residue level is also shown in Table (2). Data demonstrated the efficient role of washing in the elimination or reduction of carbaryl from dusted potato tubers. The amount of carbaryl in washed potato tuber after one hour post treatment was reduced by 99.28% of the initial application.

In spite of the level of carbaryl was decreased after washing the stored dusted potatoes the carbaryl level as well as reduction percentage was proportionally decreased with extending the storage period. These findings might be attributed to the possible penetration of carbaryl through the peels to the inner tuber.

In this respect, Zohair (2001) reported that some organophosphorus and organochlorine compounds in the naturally contaminated potatoes were greatly reduced by washing and soaking in different solutions as the percentage of removal ranged from 98.5 to 100%.

Washing and peeling processes of the treated potato tubers led to complete elimination of carbaryl residues (100%) after one hour post treatment (Table 2).

Table (2): Effect of washing, peeled and cooking on carbaryl residues in potato tubers after different periods post treatment.

Time after treatment (days)	Carbaryl residues (ppm)**									
	Unwashed		Washed		Washed and boiled (30min)		Washed and peeled		Washed and fried	
	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %
Initial*	39.17	0.00	0.28	99.29	a	100	a	100.00	a	100
15	38.97	0.51	0.76	98.05	a	100	0.01	98.68	a	100
40	36.23	7.51	1.37	96.22	a	100	0.04	97.08	a	100
70	28.84	26.37	1.71	94.07	a	100	0.05	97.08	a	100
140	19.76	49.55	2.24	88.66	a	100	0.09	95.98	a	100

*** Sample were taken one hour after spraying**
**** Each residue value is the average of three replicates**
a: Not detectable

The results of Cano *et al.* (1987) are in the same line of the obtained results. They found that most fungicide residues in pome fruits were retained in the peel showing a decline residue gradient from peel to core during the 3 months of storage post harvest treatment.

Similarly, Abdel Razik *et al.* (1984) declared that washing and peeling significantly decreased pirimiphos-methyl from potato tubers, indicating 99% reduction after 48 days post treatment.

The effect of cooking (boiling or frying) on carbaryl residues of potato tubers is also illustrated in Table (2). Results indicated the efficiency of processing in elimination carbarly from the dusted potato tubers. Despite of the very small amount of carbaryl residue penetrated into pulp, washing, peeling and cooking completely eliminated the remained and penetrated carbaryl from potatoes. Thus such, processes could be considered efficient treatments for carbaryl residue removal from the dusted potatoes (at 10% level).

These results are in agreement with those reported by Zidan *et al.* (1997).

In this respect, El Shemy *et al.* (1992) noted that the reduction of pesticides residues level due to different processes varied among the various pesticides according to the rate of penetration and/or degradation.

Thus, it could be concluded that thoroughly washing of the treated potatoes with carbaryl by running tap water removed most of the initial deposit of carbaryl residues. In addition, peeling and cooking by either boiling or frying resulted in production of potatoes free from carbaryl residues. Thus, human beings can consume safely potatoes treated with carbaryl either directly post treatment or after storage for 140 days after washing, peeling and cooking by either boiling or frying.

The effect of boiling and the time passing after applying pesticides for vine leaves on the residues are shown in Tables (3) and (4). It is obvious that after one day post treatment vine plant, these pesticides residues were decreased. The reduction percentages were 90.29, 75.17 and 71.88 for pirimiphos-methyl, formothion its degradative product dimethoate and malathion, respectively in unboiled vine leaves.

Table (3): Effect of boiling process on malathion and pirimiphos-methyl residues in treated vine leaves after different periods post pesticide spraying.

Time after treatment (days)	Malathion Residues **				Pirimiphos-methyl residues **			
	Unboiled		Boiled		Unboiled		Boiled	
	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %
Initial*	270.64	0.00	115.66	57.26	257.440	0.00	123.468	52.40
1	76.11	71.88	35.86	52.88	25.239	90.29	20.754	17.79
3	13.25	95.15	---	---	9.018	96.50	---	---
6	3.95	98.04	---	---	1.855	99.28	---	---
10	0.97	99.64	---	---	0.955	99.63	---	---

* Sample were taken one hour after spraying
** Each residue value is the average of three replicates

Table (4): Effect of boiling process on formathion and its degradative product dimethoate residues in the treated vine leaves after different periods post pesticide spraying**

Time after treatment (days)	Formothion (Anthio)				Dimethoate				Formothion + Dimethoate			
	Unboiled		Boiled		Unboiled	Boiled			Unboiled		Boiled	
	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %	Level (ppm)	Reduction %
Initial*	9.98	0.00	1.05	89.49	64.29	0.00	1.55	97.59	74.27	0.00	2.60	96.50
1	6.92	30.66	0.10	98.56	11.52	82.08	0.77	93.32	18.44	75.17	0.87	95.28
3	1.29	87.07	---	---	5.76	91.04	---	---	7.05	90.51	---	---
6	0.72	92.76	---	---	2.90	95.49	---	---	3.62	95.31	---	---
10	0.01	99.90	---	---	1.09	98.30	---	---	1.10	98.52	---	---

* Sample were taken one hour after spraying
** Each residue value is the average of three replicates

Table (5): Residue half life and maximum residue limits (MRL'S) of some pesticides on and in tomatoes, potatoes and vine leaves.

Pesticide	Plant material	Half life	MRL'S (ppm)	Harvest time post treatment (day)
Chorpyrifos-methyl	Tomatoes	23hours	0.5	3
Profenofos	Tomatoes	21 hours	--	10
Carbaryl	Potatoes	140 days	0.2	--
Malathion	Vine leaves	17 hours	8.0	6
Pirimphos-methyl	Vine leaves	13 hours	2.0	6
Formothion+ methoate	Vine leaves	16 hours	1.0	10

It is worthy to mention that more than 90% of the initial values were eliminated after 3days post spraying the insecticides. This values were significantly dissipated till reached level more than 95% and exceeded 98% after 10 days post spraying. The behavior of the used pesticides residues in vine leaves varied according to the kind of pesticide used for vine plant spraying. The greatest reduction after on day in residues post treatment was noticed for pirimiphos-methyl (90.29%), followed by formothion+dimethoate (75.17), while the least one was observed for malathion (71.87%). However, after 3 days the reduction rates of residues from malathion and formothion+ dimethoate in unboiled vine leaves were markedly increased to reach 95.10% and 90.51%, respectively. This percentage for pirimiphos-methyl was 96.5%.

The residues of pesticides continued to decrease with the passage of time post treatment. The reduction percentages in vine leaves after 6 days post spraying reached 99.28, 98.54 and 95.13% for pirimiphos-methyl, malathion and formpthion + dimethoate, respectively. After 10 days of application, these values were increased to 99.63, 99.64 and 98.52 for the three pesticides in the respective order.

In this respect, El Sayed *et al.* (1976) found that the initial deposits sulprofos sharply dropped in moloukhia leaves within the first 24 hours after application.

The effect of boiling on pesticides residues is also studied and results are shown in Table 4. Data indicated that heat treatment beside elapse of time past spraying led to complete elimination of all the used pesticides after 3 days post application.

After one hour of application, boiling vine leaves removed more than half of the initial amounts of malathion and pirimiphos-methyl, while eliminated 96.50% of formothion+dimethoate.

After one day of spraying, boiling was more effective in reducing residues. Boiling reduced the residues of formathion + dimethoate pirimiphos methyl and malathion by 95.28, 91.93 and 86.74%, in the respective order.

Such findings are in the same line with those of Haggag (1994) who found that blanching removed 99% of hostathion from moloukhia.

Similarly, El Sayed *et al.* (1976) found that residue on moloukhia leaves suddenly dropped after 3 days past spraying.

Table (4) also indicated that formothion was partially converted to dimethoate. Dimethoate continued to rapidly decreased recording percentage losses exceeding 82.08 after one day till reaching 98.30 after 10 days post application.

Finally, it could be concluded that during the first twenty four hours the residues of pirimiphos-methyl showed the highest reduction percentage (98.19%), followed by formothion+Dimethoate (75.87%), then malathion (71.87). Boiling indicated an effective role in eliminating residues. After three days of spraying, the boiled vine leaves were free of pesticide residues, it was also observed that high deposits were observed for vine leaves treated with different pesticides, indicating the relation between the treated surface and the amount of residues deposits as well as the used concentration of pesticide and the initial amount of deposits.

These results are in full agreement with those of Nasr (1981) and Haggag (1994).

From the above results, it is obvious that pesticides should be applied correctly according to the suggested agricultural practice, using only the recommended amounts.

The Half-life values and the safe interval post treatments are illustrated in Table (5). The residue half life values of the studied pesticides in the different plant materials were calculated from the reduction rate of each pesticide. It could be noticed that these values were 23 and 21 hours for chlorpyrifos-methyl and profenofos for tomato fruits, respectively under the normal filed condition. These values were 17, 13 and 16 hours for malathion, pirimiphos-methyl and formothion+dimethoate on vine leaves, respectively. It was 140 days for carbaryl in potatoes in tuber pit condition. From these results, it could be concluded that time intervals between pesticides applying and harvesting should be considered as an important factor affecting the residues of such pesticides.

Fresh tomato fruits could be safely used for human consumption just after three days post spraying with chlorpyrifos-methyl where its residues were reduced to less than the tolerance level (0.5 ppm) as recommended by Codex Aliminterius Commission of FAO/WHO (1997).

Allowable tolerance level of profenofos on vegetable is unknown till now. So for safety tomato fruits have to be marketed free from profenofos residue. It is suggested that harvesting tomato fruits should not be carried out before at least 10 days post spraying with profenofos either for processing or for fresh consumption. In potato tubers carbaryl residues detected after 140 days post application exceeded the maximum residue limits (MRL's) of carbaryl by 100 fold permitted according to the Codex Aliminterius Commission of FAO/WHO (1997). This indicated that the storage of treated potatoes till 140 days has a little effect on reducing carbaryl residues. Cooking potatoes either by boiling or frying combined with washing and peeling was efficient in eliminating carbaryl from potatoes.

The harvest time post spraying vine leaves with malathion and pirimiphos-methyl was nearly the same being 17 and 13, hours, respectively. However, for vine leaves treated with formothion this value was much more (39 hours). Vine leaves could be marketed for human consumption after 6 days of spraying either by malathion or pirimiphos-methyl.

However harvesting time of vine leaves treated with formothion should not be carried out before at least 10 days post spraying, till its residues were reduced to less than the tolerance level (1ppm). In this respect, Khan *et al.*, (1985) and El Sayed *et al.*, (1976) reported that the safe period of harvesting vegetables treated with organophosphorus pesticides ranged from one to twelve days post spraying, depending on the applied pesticide and the kind of crop.

It is worth mentioning that these above mentioned recommendations were set for foods which were not subjected to any processing. Processing steps, such as washing, peeling and cooking would cause extra removal of pesticide residues in the treated vegetable to be lower than the tolerance level.

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متبقيات المبيدات في الطماطم والبطاطس وأوراق العنب

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تم دراسة مدي كفاءة عمليات الغسيل والأعداد والطهي وكذلك الفترة بعد رش المبيدات في إزالة متبقيات المبيدات من الخضروات المعاملة بها. وقد بينت النتائج بعض الاختلافات بين المبيدات المستعملة والخضروات المعاملة. وقد تبين أن أعلي مقدار لتراكم المبيدات عند استخدام الماللاثيون والبيريمنوس ميثيل والفورمثيون علي أوراق العنب مشيرة إلي العلاقة بين السطح المعامل وتراكم المبيدات وقد وجدت أعلي تركيز للمتبقيات في أوراق العنب بينما أقلها في ثمار الطماطم. كما تبين أن أعلي سرعة لإزالة كمية متبقيات المبيدات المستعملة علي الطماطم وأوراق العنب بعد ٢٤ ساعة من المعاملة ثم بدأت بعد ذلك في الانخفاض. وعلي الرغم من زيادة كمية المبيدات المتراكمة (أو المترسبة) بعد ساعة واحدة من المعاملة فقد كانت أعلي سرعة انخفاض للمتبقيات عند استعمال بيريمفيوس ميثيل ثم الفورمثيون وأخيراً المالاثيون بعد أربعة وعشرون ساعة من المعاملة وقد كانت سرعة الانخفاض للمتبقيات في الطماطم عند استخدام بيريمفيوس ميثيل أعلي قليلا عن البروفينوفوس وقد تناسبت سرعة الانخفاض في المتبقيات في كل من (البطاطس – الطماطم – أوراق العنب) المرشوشة بزيادة المدة بعد المعاملة. أما بالنسبة للبطاطس فإن متبقيات الكاربريل كانت عالية لفترة طويلة ويعزي التكسير البطيء للكاربريل للظروف العادية في النوالات وليس لثبات.

وقد أظهرت النتائج أن فترة نصف العمر لكل من الكلوروبيريفوس ميثيل والبروفينوفوس كانت ٢٣، ٢١ ساعة علي التوالي في ثمار الطماطم كما كانت هذه الفترات ١٧، ١٣، ١٦، ساعة بالنسبة للملاثيون والبريميقوس والفورمثيون في أوراق العنب علي التوالي. بينما بلغت هذه القيمة ١٤ يوماً للكاربريل في البطاطس تحت ظروف النوالات. وتبين هذه النتائج أنه يمكن تسويق الطماطم بعد ثلاثة أيام من معاملتها بكلوربيريفوس ميثيل وعشرة أيام في حالة رشها بالبروفينوفوس. كما يمكن تسويق أوراق العنب بعد ستة أيام من رش النبات المالاثيون أو البريميقوس ميثيل بينما تزيد هذه الفترة إلي عشرة أيام عند استعمال مبيد الفورمثيون.

بينما عند استعمال الكاربريل لتعفير البطاطس لا ينصح باستخدام البطاطس للاستهلاك الأدمي بينما يسمح فقط لوقاية درنات البطاطس لحمايتها من الإصابة بالآفات لاستخدامها لزراعة عروه جديدة. وقد أظهر الغسيل كفاءة للإزالة الجزئية لمتبقيات المبيدات المستخدمة من الطماطم وأوراق العنب حتى بعد يوم واحد من المعاملة أن الغسيل الجيد للبطاطس المعاملة بالكاربريل يؤدي إلي التخلص من معظم المتبقيات بعد ساعة واحدة من المعاملة كذلك فقد أدي سلق أوراق العنب وتركيز عصير الطماطم لعمل الصلصة إلي التخلص كلياً من متبقيات المبيدات المستعملة بعد ثلاث أيام من المعاملة وقد نتج عن طهي البطاطس سواء بالسلق أو التحمير بعد الغسيل مع التقشير أو بدونه التخلص كلياً من متبقيات الكاربريل من البطاطس المعفرة حتى بعد المعاملة مباشرة.