Risk Assessment of Dietary Exposure to Chlorpyrifos Residues on some Fruits, Vegetables and Herbs in Egypt during 2002

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ABSTRACT

The central laboratory for pesticide residues analysis and heavy metals in food have been set up by the Egyptian Ministry of Agriculture and Finland conducts tests to evaluate the safe usage of pesticides in Egypt. Chlorpyrifos is one of the most widely applied organophosphate insecticide, It is classified as a General Use Pesticide (GUP) and it is registered for agriculture uses with 64 crop in the Egypt . A total of 12919 samples of 57 different types of fruit ,vegetable, and aromatic medicinal plants samples were examined for chlorpyrifos residues during 2002. It was found that fifteen commodities represent 5.62 % were completely free of chlorpyrifos residues. Forty three commodities represent total 12193 samples of fruits (2634), vegetables (2494) and aromatic medicinal plants (7065) with percentages 94.38 % of total examined samples have chlorpyrifos residues (contaminated commodities) . Only 10.16% of the total contaminated commodities (12193 samples) were below limit of determination (LOD = 0.02 ppm), 9.62 % at LOD or more However 80.21 % of those samples are not contaminated with chlorpyrifos residues. Only 6.33 % of the samples exceeded MRL's of chlorpyrifos residues comparing with national, codex and EU-MRL's. Chlorpyrifos residues were the detected frequently in dry celery and cumin samples with percentages of 61.54 % and 40.91 %, respectively and also showed higher violation rate for the same commodities 58.97 % and 40.91 % . The major contributors to total intake of chlorpyrifos residue is the root vegetables (81.89 %). Data showed that the total dietary intake of chlorpyrifos is to be 0.0045 mg/kg. body weight /day is lower than ADI (0.01 mg/kg body weight) and contributing only 45 % of ADI . Therefore dietary exposures to chlorpyrifos are still not a case for Egyptian consumer concern.

Key words: Chlorpyrifos, Exposure assessment, Residue, Monitoring, Fruits and Vegetables, aromatic and medicinal plants

INTRODUCTION

Chlorpyrifos has been used for agricultural and urban pest control over the last 30 years. It is the most widely applied organophosphate insecticide, with registrations in over 88 countries. Chlorpyrifos is toxicity class II - moderately toxic. Products containing chlorpyrifos bear the Signal Word WARNING or CAUTION, depending on the toxicity of the formulation. It is classified as a General Use Pesticide (GUP). It is used on crops – with 64 approved agricultural uses in the Egypt – as well as in many non crop (residential/home)

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situations. It is a broad-spectrum material that controls nearly all economically important pests EPA, 1989.

Chlorpyrifos is a diethyl phosphorothionate, which is metabolized to the active oxon via oxidative desulfuration. Chlorpyrifos is rapidly metabolized and excreted as a TCP (trichloropyridinol) metabolite; it does not accumulate in the body. TCP can be used in biomonitoring to assess chlorpyrifos exposure. The most sensitive known endpoint of exposure for humans is inhibition of plasma cholinesterase. The new cumulative risk assessment guidelines use the finding that OP pesticides share a common mechanism of toxicity, which considered as cholinesterase activity Mileson *et al.* 1998 and U.S. EPA (1999 and 2001).

The NOEL (no observable effect level) for chlorpyrifos is 30 µg/kg body weight per day for chronic exposures, while it is 100 µg/kg/day for acute (single dose). Studies of exposed individuals finds exposures in range of 1 µg/kg, which is just one percent of NOEL (Barzak *et al.*, 1998) .

FQPA represents a compromise with environmentalists who were willing to exchange the pesticide regulation method of the Delaney clause – a law passed in 1950 that bans adding carcinogens, as defined by animal ingestion studies, to the diet – for new language that focuses on protection for children. FQPA substitutes the risk/benefit methodology that formerly regulated these pesticides for the Food and Drug Administration's standard of "reasonable certainty of no harm." This means that there is reasonable certainty that no harm will result from aggregate exposures to pesticide chemical residue, including all anticipated dietary exposures and all other exposures for which there are reliable information (FQPA, 1999).

With regard to acute exposures, the oral LD50 is in the range of 135 to 160 mg/kg of body weight Gallo and Lawryk 1991. If chlorpyrifos is applied to skin, the LD_{50} is greater than 2,000 mg/kg; if it's inhaled, one can't get enough vapor in the air to create an effect (Anonymous, 1986). Chlorpyrifos was not genotoxic (EPA 1989).

Monitoring programs can be contribute in improving safety of food, warning of actual and potential food contamination via food and evaluations of possible health hazards throughout providing continuous information on levels of environmental pollution in the country. Public concern over pesticide residues on vegetables and fruits has been increased in recent years. The risk to human health is due to pesticide residues in the edible parts. The objectives of food contamination monitoring programmes are to safeguard health, to improve the management of food and agricultural resources as well as preventing economic losses. The benefits to be derived from national monitoring programmes are

improved food safety, warning of problems of contamination, provision of intake data for evaluation of health hazards, better management and use of natural resources and a series of measures of good agricultural practice (GAP). The current study was conducted as a part of the main national food contamination monitoring program that has been carried out in Egypt since 1988 by Dogheim *et al.* (1988, 1990, 1991, 1999, 2001 and 2002).

MATERIALS AND METHODS

Sampling

A total of 12919 samples of Local and imported vegetables, fruits and some aromatic medicinal plants were collected from different local markets representing 5 Egyptian Governorate include (Qalyubiya- Giza – Ismailia – Minufiya and Beni Suef throughout 2002. The vegetables, fruits and medicinal plant samples that selected for the survey were, demonstrated in table (1). Two kg from vegetables, fruits and 500g from aromatic medicinal plants for each commodity was thoroughly homogenized and prepared according to Codex Alimentarius Guidelines (1993). Chlorpyrifos residues are subjected for analysis in all samples.

Pesticide Residues Analysis

The Official method of AOAC, 1995 was followed with some modifications in which were, the sample and the solvent amounts are only half of those mentioned in AOAC method. Rotary evaporator and air below are used instead of Kuderna-Danish as concentrators. The total volume of acetone extract is measured for result calculations. However, the AOAC method uses tabulated water percentages of commodities. After drying, aromatic phase is concentrated just to dryness. The dried samples were dissolved in hexane /acetone containing 0.3 µg/ml of ditalimphos as an internal standard for GC determination.

GC Determination

The detection and confirmation of presence of residues in the samples depends on the use of two chromatography columns of different polarities equipped with nitrogen-phosphorus detectors (NPD) installed in one GC instrument with one injector. Quantitative determinations are made using ditalimiphos as an internal standard.

Quality Assurance:

The analytical method and instruments were fully validated as part of a laboratory quality assurance system and are accredited by Finnish Accreditation Service FINAS (center of metrology and accreditation) Finland. The criteria of quality assurance of the codex committee are followed to determine the performance of the multiresidue method.

The average recoveries percentages of the tested pesticides on chamomile were ranged between 80-102% at spiking levels 0.07 -0.1 mg/kg, with coefficient of variation (CV%), 2.5-13%. However, the average recoveries, coefficient of variation (CV%) of the tested compounds on pepper samples at spiking levels 0.02-0.5 mg/kg were 80-106%, 2-19% respectively. The reproducibility expressed as relative standard deviation was less than 20%. The limit of quantification was 0.02 mg/kg. The measurement uncertainty including random and systematic error at 95% confidence level is less than 10%.Blank sample is fortified with the pesticides mixture and analyzed as normal sample with each set of samples. The results are recorded on control charts. Repeated analysis of old samples is regularly followed to control reproducibility

♦ **Apparatus**

(2) Gas chromatography: HP 5890 equipped with double Nitrogen Phosphorus Detector (NPD) with two capillary columns, injector 225°C, detector 280°C. Operating The flow rate gases were: Hydrogen 3.5 ± 0.1 ml/min, Air 100-110 ml/min, and Nitrogen carrier gas 25 ml/min.

Chromatography columns are:

(1) PAS-5 NPD tested ultra 2 silicon, 25m x 0.32 mm, and film thickness 0.52 µm

(2) PAS – 1701 NPD tested 1701 silicon, 25 m x 0.32 mm, film thickness 0.25 µm.

Temperature programmes of both GC instruments are; initial temperature 90°C for 2 min, ramp (1) 20°C / min) to 150°C, ramp (2) 6°C/min to 270°C hold 15min.

♦ **Reagents**

*** Solvents and chemicals**

(a) Acetone, dichloromethane, n-hexane and petroleum ether, (Pestiscan chromatography grade or similar quality).

(b) Anhydrous sodium sulphate (Riedel-de Haen) and sodium chloride

♦ **Pesticide reference standards**

Chlorpyrifos reference material is a certified standard provided by Dr. Ehrenstorfer laboratories Gmbh, Gogginger Str. 78 D- 8900 Augsburg Germany and financed by FAO (Food and Agriculture Organization of the United Nations), Rome, Italy.

RESULTS AND DISCUSSION

A total of 12919 samples of 57 different types of fruit, vegetable, and aromatic medicinal plants samples were examined for chlorpyrifos residues during 2002 and the results are shown in table (1) and (2). Fifteen commodities represent 726 samples with percentages 5.62 % were completely free of chlorpyrifos residues. Chlorpyrifos residues, usually analyzed by multiresidue method capable of detecting up to 82 or more pesticides. Forty three commodities represent total 12193 samples of fruits (2634), vegetables (2494) and aromatic medicinal plants (7065) with percentages 94.38 % of total examined samples were found to be contain chlorpyrifos residues.

Tables 1 and 2 showed the levels of chlorpyrifos detected in cation fruits, vegetables and aromatic medicinal plants samples. European union (EC), Egyptian Organization of Standardization (EOS) and codex maximum residue limits were followed and due to lack of chlorpyrifos codex MRL's on such these commodities combinations. The EC maximum residue limits was used followed by EOS then codex to evaluate the results. In few cases extrapolation was followed in such crops that didn't include in codex or at any guidelines and produced locally such as grape leaf and molokhia and larkspur flower. The contaminated commodities have detectable chlorpyrifos residues below limit of determination (LOD) were found in 1239 sample with 10.16%, contaminated samples at LOD or more were 1174 sample with 9.62 %, meaning the total contaminated samples were 2413 sample (1239 + 1174 sample) with 19.79 %, However the samples not contaminated with chlorpyrifos residues were 9347 sample with 80.21 %. Only 772 sample represent 6.33 % exceeded MRL's of chlorpyrifos residues comparing with national, codex and EU-MRL's data and records.

Chlorpyrifos residues were detected frequently in apples and grapes leaf samples with percentages of 13.2% and 8.7%, respectively but Green onion showed higher violation rate 6.03 % followed by hot chili, okra and grape leaf with percentages of 4.35 % for all of them which indicates that we should pay attention more extensively to apply good agricultural practices for chlorpyrifos use especially for these commodities.

In the case of aromatic medicinal plants chlorpyrifos residues were the detected frequently in dry celery and cumin samples with percentages of 61.54 % and 40.91 %, respectively and also showed higher violation rate for the same commodities 58.97 % and 40.91 % which indicates that we need to put a extensive plane to apply good agricultural practices for chlorpyrifos use for both commodities.

Oranges, watercress and potatoes showed the lowest contamination rates of 2.36 %, 1.15 % and 1.85 %, respectively with slightly violation percentages 1.15 % and 0.69 % for watercress and potatoes .No violation observed in orange, tomatoes and cabbage. However, in case of aromatic medicinal plants dry coriander samples showed the lowest contamination rate than all herbs.

The Food Quality Protection Act, 1999 stipulates that when determining the safety of a pesticide chemical, EPA shall base its assessment of the risk posed by the chemical on, among other things, available information concerning the cumulative effects to human health that may result from dietary, residential, or other non-occupational exposure to other substances that have a common mechanism of toxicity.

A person exposed to a pesticide at a level that is considered safe may in fact experience harm if that person is also exposed to other substances that cause a common toxic effect by a mechanism common with that of the subject pesticide, even if the individual exposure levels to the other substances are also considered safe. Chlorpyrifos is a member of the organophosphate (OP) class of pesticides. All the pesticides of this class contain phosphorus at an and other members of this class of pesticides are numerous . EPA consider the organophosphate pesticides should be considered as a group when performing cumulative risk assessments Clegg, and van Gemert, 1999.

In the framework it is stated that a cumulative risk assessment of substances that cause a common toxic effect by a common mechanism will not be conducted until an aggregate exposure assessment of each substance has been completed. This framework is need more studies to be finalized . The causes of risk to human health are due to the pesticide residues in the edible parts of the crop and the consequent daily intake of these residues. The acceptable daily intake (ADI) of the chlorpyrifos derived from the chronic toxicity data. The established ADI value of chlorpyrifos in Egypt are indicated in codex published by Food and Agriculture Organization of united nations (FAO) which is 0.01 mg/kg body weight. The EDI (Estimated daily intake) of a chlorpyrifos by Egyptian people is calculated from the Middle Eastern food consumption GEMS / food data and chlorpyrifos residue monitoring data using an average body weight of 60 kg/5 cm.

The current exposure assessment addressed only the risks posed by chlorpyrifos residues in fruits, vegetables and herbs. The contributors to total intake of chlorpyrifos are in descending order as follows root vegetables (81.89%), fruiting vegetables (7.6 %), fruits (4.98 %), Leafy vegetables (2.91 %), green herbs (1.71%) and dry herbs (1.41%). The major contributors crops to total intake of chlorpyrifos are potatoes (76.51%) followed by green onions (4.87%), tomatoes (4.8%) and grapes (2.53%),

The risk exposure assessment of chlorpyrifos residues results are shown in Table 3 . Data showed that the total dietary intake of chlorpyrifos 0.0045 mg/kg. body weight /day is lower than ADI (0.01 mg/kg body weight) and contributing only 45 % of ADI . Therefore dietary exposures to chlorpyrifos are still not a case for Egyptian consumer concern.

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Table 1. Monitoring data of chlorpyrifos residues in some fruit and vegetables collected from local markets in 2002

Commodity	Total No. of samples	Freq. %	contaminated samples		Min. conc. ppm	Max. conc. ppm	Mean conc. ppm	MRL's mg/kg	No. of violated samples	Violation %
			No	%						
Fruits										
Apples	2342	13.2	866	36.9	0.05	0.62	0.132	0.50 EC	4	0.17
Figs	27	3.70	1	3.70	0.22	0.22	0.220	0.05 EC	1	3.70
Grapes	138	6.52	26	18.8	0.05	1.50	0.434	0.50 CXL	2	1.45
Oranges	127	0.79	3	2.36	0.11	0.11	0.110	1.00 CXL	0	0.00
Vegetables										
Fruiting vegetables										
Cucumber	123	3.25	17	13.82	0.05	0.13	0.088	0.05 EC	3	2.44
Egg plants	117	0.85	3	2.56	0.07	0.07	0.070	0.05 EC	1	0.85
Green beans	404	3.96	34	8.42	0.02	1.60	0.200	0.02 EOS	14	3.47
Hot Chili	138	5.80	10	7.25	0.01	0.49	0.303	0.05 EC	6	4.35
Okra	69	4.35	6	8.70	0.06	0.07	0.063	0.05 EC	3	4.35
Pepper	166	3.61	13	7.83	0.05	7.90	1.547	0.05 EC	6	3.61
Squash	113	1.77	3	2.65	0.06	0.07	0.065	0.05 EC	2	1.77
Strawberry	57	3.51	2	3.51	0.06	1.90	0.980	0.30 EOS	1	1.75
Tomatoes	149	1.34	9	6.04	0.08	0.24	0.160	0.50 CXL	0	0.00
Leafy vegetables										
Cabbage	87	1.15	1	1.15	0.07	0.07	0.070	1.00 CXL	0	0.00
Dry Molokhia	86	2.33	3	3.49	0.11	1.00	0.555	0.05 EOS*	2	2.33
Grape leaf	69	8.70	12	17.40	0.10	1.10	0.548	0.05 EOS*	3	4.35
Lettuce	78	2.56	2	2.56	0.04	0.05	0.045	0.05 EC	0	0.00
Green Molokhia	111	3.60	9	8.11	0.08	0.74	0.368	0.02 EOS*	4	3.60
Water Cress	87	1.15	1	1.15	0.10	0.10	0.100	0.02 EC	1	1.15
Root vegetables										
Carrot	91	3.30	7	7.69	0.08	0.48	0.220	0.10 CXL	1	1.10
Green Onion	116	6.90	18	15.50	0.05	2.70	0.575	0.05 EC	7	6.03
Potatoes	433	0.69	8	1.85	0.06	7.30	3.520	0.05 EC	3	0.69

* (Codex) Codex Alemintariuos commission, (Min) Minimum, (Max) Maximum, (EC) European union (MRL's) Maximum Residue Limits, (Freq) Frequency, (EC) European union, (EOS) Egyptian Organization of Standardization , (ppm) part per million (*) Extrapolated.
* The analyzed commodities (cantaloupe 79, guava 77, lemon 15, peach 31, pear 23, plum 20, pomegranate 33, Green peas 79, celery 13 and Spanish 71) 442 samples are free of chlorpyrifos residues.
* Total No of contaminated commodities analyzed are 5128 samples

Table 2. Monitoring data of chlorpyrifos residues in some aromatic and medicinal plants collected from local markets in 2002.

Commodity	Total No of samples	Freq. %	contaminated samples No	contaminated samples %	Min. conc. ppm	Max. conc. ppm	Mean conc. ppm	MRL's mg/kg	No of samples violated	Violation %
Dry										
Anise Seeds	219	14.61	41	18.72	0.05	11.00	0.806	0.05 EOS*	30	13.70
Basil	737	5.97	166	22.52	0.05	0.62	0.115	0.05 EOS*	36	4.88
Calendula Flower	74	2.70	6	8.11	0.05	0.32	0.185	0.05 EOS*	1	1.35
Chamomile	1022	2.45	61	5.97	0.04	1.80	0.236	0.05 EOS*	16	1.57
Cumin	176	40.91	76	43.18	0.06	34.00	1.613	0.05 EOS*	72	40.91
Dry Celery	39	61.54	28	71.79	0.05	0.54	0.213	0.05 EOS*	23	58.97
Dry Coriander	278	1.08	5	1.80	0.06	0.15	0.113	0.05 EOS*	3	1.08
Dry Dill	111	10.81	31	27.93	0.05	0.82	0.228	0.05 EOS*	10	9.01
Dry Mint	2442	19.16	711	29.12	0.02	18.00	0.625	0.05 EOS*	430	17.61
Dry Parsley	135	10.37	31	22.96	0.05	0.21	0.099	0.05 EOS*	9	6.67
Fennel	526	4.37	40	7.60	0.05	2.50	0.526	0.05 EOS*	21	3.99
Hibiscus	219	1.83	9	4.11	0.08	0.12	0.108	0.05 EOS*	4	1.83
Lemon Grass	142	0.70	4	2.82	0.06	0.06	0.060	0.05 EOS*	1	0.70
Marjoram	619	4.20	90	14.54	0.05	0.69	0.192	0.05 EOS*	23	3.72
Rosemary	7	14.29	2	28.57	0.11	0.11	0.110	0.05 EOS*	1	14.29
Tillio	4	25.00	2	50.00	0.06	0.06	0.060	0.05 EOS*	1	25.00
Green										
Green Coriander	89	5.62	10	11.24	0.18	3.20	1.506	0.02 EOS*	5	5.62
Green Dill	86	6.98	18	20.93	0.07	0.19	0.105	0.02 EOS*	6	6.98
Green Mint	53	13.21	10	18.87	0.10	3.80	1.151	0.02 EOS*	7	13.21
Green Parsley	87	10.34	18	20.69	0.16	15.00	4.149	0.02 EOS*	9	10.34

* (Min) Minimum, (Max) Maximum, (EC) European union (MRL's) Maximum Residue Limits, (Freq) Frequency, (EC) European union, (EOS) Egyptian Organization of Standardization , (ppm) part per million (*) Extrapolated.
* The analyzed commodities (calendula petals 35, Caraway 228, Larkspur flower 4, and verbascum 17) 284 samples were found to be free of chlorpyrifos residues
* Total No of contaminated commodities analyzed 7065 samples.

Table 3. The estimated daily intake and intake percentages of chlorpyrifos residues for fruit, vegetables and herbs according to middle eastern food consumption data.

Commodity	Chlorpyrifos residues Mean (ppm)	Middle eastern Food consumption gm/person/day	Estimated Daily Intake (EDI) µg/day	% Intake
Fruits				
Apples	0.132	7.5	0.99	0.36
Figs	0.220	2.3	0.51	0.19
Grapes	0.434	15.8	6.86	2.53
Oranges	0.110	47.1	5.18	1.91
Subtotal fruit			**13.53**	**4.98**
Vegetables				
Fruiting vegetables				
Cucumber	0.088	4.8	0.42	0.15
Egg plant	0.070	6.3	0.44	0.16
Green beans	0.200	3.5	0.70	0.26
Hot Chili	0.303	0.1	0.03	0.01
Okra	0.063	0.8	0.05	0.02
Pepper	1.547	3.4	5.26	1.94
Squash	0.065	10.5	0.68	0.25
Strawberry	0.980	0.0	0.00	0.00
Tomato	0.160	81.5	13.04	4.80
Subtotal Fruiting vegetables			**20.63**	**7.6**
Leafy vegetables				
Cabbage	0.070	0.18	0.35	0.13
Dry Molokhia	0.555	23.0	0.28	0.10
Grape leaf	0.548	59.0	4.27	1.57
Lettuce	0.045	5.0	0.10	0.04
Green Molokhia	0.368	0.5	2.87	1.06
Water Cress	0.100	7.8	0.01	0.00
Subtotal Leafy vegetables			**7.89**	**2.91**
Root vegetables				
Carrot	0.220	0.18	0.04	0.01
Green Onion	0.575	23.00	13.23	4.87
Potatoes	3.520	59.00	207.68	76.51
Subtotal Root vegetables			**220.94**	**8139**
Subtotal Vegetables			**249.46**	**91.9**

Continue Table (3).

Commodity	Chlorpyrifos residues Mean (ppm)	Middle eastern Food consumption gm/person/day	Estimated Daily Intake (EDI) µg/day	% Intake
Dry				
Anise Seeds	0.806	2.3	1.85	0.68
Basil	0.115	0.3	0.03	0.01
Calendula Flower	0.185	0.0	0.00	0.00
Chamomile	0.236	0.3	0.07	0.03
Cumin	1.613	0.5	0.81	0.30
Dry Celery	0.213	0.1	0.02	0.01
Dry Coriander	0.113	0.5	0.06	0.02
Dry Dill	0.228	0.1	0.02	0.01
Dry Mint	0.625	2.3	1.44	0.53
Dry Parsley	0.099	0.1	0.01	0.00
Fennel	0.526	0.3	0.16	0.06
Hibiscus	0.108	0.1	0.01	0.00
Lemon Grass	0.060	0.0	0.00	0.00
Marjoram	0.192	0.1	0.02	0.01
Rosemary	0.110	0.0	0.00	0.00
Tillio	0.060	2.3	0.14	0.05
Subtotal Dry Herbs			**4.64**	**1.71**
Green				
Green Coriander	1.506	0.5	0.75	0.28
Green Dill	0.105	0.1	0.01	0.00
Green Mint	1.151	2.3	2.65	0.98
Green Parsley	4.149	0.1	0.41	0.15
Subtotal Green Herbs			**3.82**	**1.41**
Subtotal Herbs			**8.46**	**3.12**
Total			**271.45**	**100**

* Calculated Dietary intake for chlorpyrifos = 271.45 /1000/60 = 0.0045 mg/kg. body weight /day
* Acceptable Daily Intake of chlorpyrifos (ADI) = 10 µg/kg body weight
* Total estimated dietary intake for chlorpyrifos as a percentage of set ADI = 0.0045 * 100 / 0.01 = 45 % .

الملخص العربي

مخاطر السمية للتعرض لمتبقي الكلوروبيريفوس في بعض الفواكه والخضر والأعشاب المستهلكة في مصر عام ٢٠٠٢

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المعمل المركزى لتحليل متبقيات المبيدات و العناصر الثقيلة فى الأغذية

وزارة الزراعة – مركز البحوث الزراعية

تم إنشاء المعمل المركزي لتحليل متبقيات المبيدات و العناصر الثقيلة في الأغذية بالتعاون بين وزارة الزراعة المصرية ودولة فنلندا لعمل الاختبارات وتقييم الاستخدام الآمن للمبيدات في مصر . مركب الكلوربيريفوس أحد المركبات الفسفورية المستخدمة بصورة واسعة لمقاومة الآفات . تم تصنيف مركب الكلوربيريفوس كمركب للاستخدام العام حيث انه مسجل على نحو ٦٤ محصول في مصر والعالم . تم اختبار عدد ١٢٩١٩ عينة من ٥٧ نوع من أنواع الخضر والفاكهة و كذلك النباتات الطبية و العطرية لمبيد الكلوربيريفوس لعام ٢٠٠٢ حيث وجد أن ١٥ نوع من أنواع المحاصيل المختبرة تمثل نسبة ٥,٦٢ % خاليه من متبقيات هذا المبيد بينما ٤٣ نوع من أنواع هذه المحاصيل بإجمالي ١٢١٩٣ عينة ٢٦٤٣ فاكهة و ٢٤٩٤ خضر و ٧٠٦٥ نباتات الطبية و العطرية بنسبة إجمالية ٩٤,٣٨ % من مجموع العينات المختبرة ملوث بمتبقي مبيد الكلوربيريفوس وتعتبر هذه الأنواع من المحاصيل ملوثة . أشارت النتائج إلى أنة ١٠,١٦ % مجموع أنواع المحاصيل الملوثة تحت حدود التقدير (٠,٠٢ جزء في المليون) كما أن ٩,٦٢ % عند أو أعلى من حدود التقدير لمتبقي مبيد الكلوربيريفوس بينما ٨٠,٢١ % من مجموع أنواع هذه المحاصيل غير ملوث بمتبقي مبيد الكلوربيريفوس . أشارت النتائج إلى أنه ٦,٣٣ % من مجموع أنواع المحاصيل الملوثة تتعدى الحدود القصوى المسموح بها مقارنة بالحدود القصوى المسموح بها محليا أو حدود منظمة الكودكس وكذلك الحدود الأوروبية . تم تعيين متبقي مبيد الكلوربيريفوس بصورة متكررة في عينات الكرفس الجاف والكمون بنسبة ٦١,٥٤ % و ٤٠,٩١ % على التوالي وقد سجلت نفس المحاصيل أعلى نسب تعدى للحدود القصوى ٥٨,٩٧ % و٤٠,٩١ %. أشارت النتائج إلى أن المحاصيل الجذرية هي أكثر المحاصيل مشاركة في المتناول الغذائي اليومي بمتبقي مبيد الكلوربيريفوس حيث وصلت هذه النسبة إلى ٨١,٨٩ % كما أظهرت الدراسة أن مجموع المتناول اليومي للخضر و الفاكهة وكذلك النباتات الطبية والعطرية للمحاصيل المختبرة لهذا المبيد للإنسان المصري ٠,٠٠٤٥ مليجرام لكل كيلو جرام من وزن جسم الإنسان في اليوم وهذه القيمة اقل من قيمة المتناول اليومي المسموح به وهو ٠,٠١ مليجرام لكل كيلو جرام من وزن جسم الإنسان في اليوم ويمثل فقط ٤٥% من قيمة المتناول اليومي المسموح به وهذا يعنى أن التعرض لمتبقي مبيد الكلوربيريفوس ليس خطيرا إلى الآن بالنسبة للمستهلك المصري.