

## *Investigation of the Residues of Chlorpyrifos and Diazinon in Apple Fruit in Damavand Region*

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### **Introduction**

Considering the increased use of fertilizers and pesticides in agriculture in recent decades and increasing risks of diseases and environmental hazards in human societies, the standards of remaining pesticides in food and agricultural products are required to be considered. In this study, residues of Chlorpyrifos ( $C_8H_{11}Cl_3NO_3P$  S) and Diazinon in apple in the Damavand region were evaluated. The increase in the world population and the lack of food resources have caused agricultural methods producing more food to be developed. The increasing use of fertilizer products and pesticides reduce the damage caused by diseases, weeds and plant pests. However, it makes the residue of pesticides in agricultural products increase. It is important to use pesticides correctly. Obtaining the compliance period of pesticides has causes people to stay healthy. Nevertheless, sometimes it is not respected. Therefore, it seems that reviewing pesticide residues in apple fruit in Damavand region is essential. Climatic diversity in the city of Damavand has provided the possibility of producing and promoting many kinds of fruits. The amount of land horticulture in this city is 9575 ha. Apple gardens area is about 7100 hectares. Peaches and nectarine gardens area is 797 hectares; cherry, 480 hectares; and walnut, 550 hectares; There are 508 ha of greenhouse areas.

**Table.1: Cultivation amount and average annual production of fruits in Damavand**

Average annual production tone/ha	Cultivation (ha)	Product name	No.
130	7100	apple	1
15	62	pear	2
13	601	cherry	3
6	45	plum	4
17	797	peach	5
3	550	Walnut	6
14	287	apricot	7
3	40	almond	8
10	15	pomegranate	9
3	30	grape	10

As it can be seen in table 1, Apple is the most important product in this region. Different types of apple are available such as Red delicious, Red golden, prime rose, etc.

The production of apple in 1986, 87 and 88 was 125, 134.5 and 132 ton/ha, respectively. Most of the productions were exported to other countries. Due to the high production and the lack of suitable conversion industries, much of these apple products are useless. Therefore, the extension and development of conversion industries is very important.

#### Sampling and testing methods

Random Sampling from the apple orchards based on statistical calculation was performed. After extracting samples, residues of pesticides were measured by Gas Chromatography method. Samples were obtained from Abe sard, Jaban, Sarbandan, and markets of Damavand city. Sampling was carried out in the time of apple harvest in the region. The samples were placed in bags. Thereafter, they were transferred to laboratory for extraction. In order to prepare homogeneous samples, first apples were chopped. Mixing them by a blender was the next step. Thereafter, Acetonitrile was added to them and the samples were centrifuged for 15 minutes. Measuring the remaining amount of pesticide was performed by gas chromatography. Gas chromatograph had been calibrated by 0.1, 1, 10, 100 and 1000 ppm of the pesticide. The analysis of samples was carried out according to the standard methods, by GC, SHIMADZU 14, and Thermal Specific Detector (TSD).

#### Results and Discussion

Results show that there are residues of pesticide in the samples. The standard amount of residues of chlorpyrifos in the world is 0.01 ppm. Average values of chlorpyrifos, SD observations and t-Statistic were calculated in tables 2 and 3.

**Table.2: Statistical analysis results**

t-Statistic critical Chlorpyrifos	t - Statistic Computational Chlorpyrifos	SD observations Chlorpyrifos	Average amount of Chlorpyrifos	varieties of apple
1.734	5.147	0.2095	1.0882	golden
1.753	6.499	0.8236	1.3483	red

**Table.3: Statistical analysis results**

t-Statistic critical Diazinon	t - Statistic Computational Diazinon	SD ob Diazinon servations	Average amount of Diazinon	varieties of apple
2.92	0.8520	0.1744	0.6486	golden
1.943	1.50	0.3578	0.7029	red

According to the results and statistical calculations and considering 95% confidence margin, and extracting the critical t, it is determined that t-statistical Computation of this pesticide in the golden apple is about 5.147 and the critical t is about 1.734. T-statistical Computation of this pesticide in the red apple is about 6.499 and the critical t is about 1.753.

As the amount of t-statistical Computation of both types of apple is more than the critical t, the residues of this pesticide are more than the world standard.

To justify the above results, it was determined that the usage of pesticides is over dose, or the effective time of pesticide is not completed. T-statistical Computation of this pesticide in the golden apple is about 0.852 and the critical t is about 2.92, t-statistical Computation of this pesticide in the red apple type is

about 1.50 and the critical t is about 1.943. The amount of t-statistical computation of both of these types is less than the critical t amounts. Thus, the residue of this pesticide is about the world standard.

According to results, the mean amount of residues of Diazinon is 0.65 and 0.7ppm, in the golden and red types of apple, respectively.

Also, the mean amount of Chlorpyrifos residue is 1.08 and 1.34 ppm, in the golden and red types of apple, respectively. The comparison of Statistical results with international standards showed that the residues of Chlorpyrifos in Damavand apple orchards exceeded the world amounts.

#### **Conclusion**

The use of fertilizer increases products reducing the damage caused by diseases, weeds and plant pests. However, it makes the residue of pesticides in agricultural products increase. This study was carried out to evaluate the residues of Chlorpyrifos and Diazinon in apple in the Damavand region. According to the results, the mean amount of Diazinon residue is 0.65 and 0.7ppm, in the golden and red apples, respectively. Also, the mean amount of Chlorpyrifos residue is 1.08 and 1.34 ppm, in the golden and red apples, respectively. Comparison of Statistical results with international standards showed that the Chlorpyrifos residues in Damavand apple orchards exceed the world mean amount.

#### **Key words**

Chlorpyrifos, Diazinon, pesticide, apple, Damavand region

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