

## Investigation and Assess Knowledge of Small Pistachio Growers in Kerman Province about Aflatoxin

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**Abstract:** In the current study with using of 553 questionnaires, knowledge of Kerman small pistachio growers regarding hygienic pistachio production especially aflatoxin was investigated. The results showed that factors such as high density of pistachio trees in the orchards and limited water resources are the main factors of creating potential of aflatoxin contamination in pistachio. These factors are not solved in a short term plans and should be considered in a long term programs. The results also showed that small pistachio growers doing most effort to observe hygienic cases and lack of knowledge in many of these areas are causing the problem. Therefore, there is a necessity to provide more extension. A survey in extension priorities of growers, also, indicated that technical extension including the definition of aflatoxin, its effect on health and etc. should be in the first priority. The next stage of “pistachio processing” and “marketing” was in second priority and pistachio orchard was the third priority. Although most of processing units are traditional, but, knowledge about them exists, so must make effort in order to solve their financial problems and executive action.

**Keyword:** growers, mycotoxin, pistachio, Iran, aflatoxin

### INTRODUCTION

Over the past decade, interest in the healthy food amongst consumers and producers has increased. In this regard, diseases and hazards in the food supply chain; attention to methods of producing and processing of agricultural products has expanded (Van Plaggenhoef, et al, 2002). In the opinion of Michel (2003), as food is an essential need for human being, consumers pay especial attention for healthy foodstuff products. Consumers are sensitive to the fact that the foodstuff should be free of pesticide residue, external material and harmful pathogen as well. Furthermore, the importance of healthy food is increasing as consumers wealth increasing. Michelle results (2003), also shows that as consumers requesting high degree of safety in foodstuff, encouraging producers to observe this issue too. Reputation obtained due to production of the healthy food worth enough, producers have sufficient incentive for producing safe foodstuff. In contrast, arising of a general negative suspension views about healthy foodstuff products, have a stable and long-term effects and will decreased the price of goods, will not simply removed from the mind as well. Despite the above matter, Michel (2003) believed that in global marketing conditions, achieving optimum health food spot is not possible; the reason for this issue is presence of a gap between social interests and market function. Causes of this gap are inadequate consumer information and social gap between the ideal level of food safety as well as ideal of consumers. Meanwhile, the producers only

consider the consumer demand. In other words, in the terms of producers, viewpoint of the other social parts do not create any interest in them, because, just consumer willingness to pay determine the price received by producers. The law of safety food in Brazilian meat market has been investigated by Azevedo and Bankuti (2002). Their results show that more flexible laws are preferred. Also, models of cost functions for USA meat market were studied by Antle (2000). His results show that the real costs on application of these laws are more than costs estimated by USDA. Cost of aflatoxin to the farm buying point, and sheller segments of the southwest United State peanut industry is estimated by Lamb and Sternitzke (2003). The results of this study show that cost of aflatoxin is 69.34 Dollar per hectare. Aflatoxin is always one of the issues regarding the pistachio in Iran. European Union as a customer of Iranian pistachio is more sensitive to this issue. In this regard, we can mention the website of the Union as following [http://europa.eu.int/comm/food/food/rapidalert/archive\\_en.htm](http://europa.eu.int/comm/food/food/rapidalert/archive_en.htm). As it is clear from this site, it is a quick warning to European consumers and households on purchasing foodstuff products. In this site, within the maximum delay of 15-day the health status of the food products in the two ports of “entry level goods to the country” and “food stores” are provided. Reports are providing weekly and there is “the name of non-health goods”, “rejection level (super Market or

Customs)", " name of exporting country" and "the reason of rejection" is determined. Therefore, if the goods are declared as non-healthy food for a few weeks, widely brought out of the consumer basket and severely reduced the demand for it. Demand reduction affects the price of the goods and reduce their volume. Referring to this site observed, during the years 2003, 2004 and 2005, rarely found a week, in which, Iranian pistachio not returned from Europe Union because of aflatoxin contamination. So that, in 2005 in all weeks of the year, rejection of aflatoxin-contaminated pistachio has been reported, belongs to Iran. On this site, also, the annual reports are presented. The last annual report in this regard is related to the year 2004. In 2004 a total of 844 cases of aflatoxin contamination have been reported in Europe Union. This amounts in comparison to the year 2003 (763 cases) was slightly higher, and is three times of the year 2002 (288 cases). From the total of 844 cases of aflatoxin-contaminated, 538 cases (64 percent) were related to the pistachio, from which about 487 cases (90 percent) imported from Iran. Also in 2004, from the total of 787 cases of mycotoxins contamination in 15 countries, 487 cases (62 percent) were related to Iran that all is to aflatoxin contamination. Other countries in this group include China, Turkey, USA, Argentina, India, Egypt, Brazil, Sudan, Italy, Spain, Germany, Britain, Hungary and Greece. It is noteworthy mention that mycotoxins contamination solely constitutes 34 percent of various forms of contamination. The total cases of infected and non-healthy products of Iran in the Europe Union in 2004, was 493 cases that in this area ranked first among 113 countries of the world. Also, Turkey with 181 cases of infection in the second rank shows a significant difference with the first rank of his. Also on base of RASFF data, rejected lots have decreased in number from 560 in 2004 to 133 lots in 2007, a 76% reduction over this 4-year period. It is also clear that the total weight of rejected pistachio lots has also declined to 2894 tons in 2007, compared to that of 12679 tons in 2004, reflecting a decrease in such volume on the order of 77%. A further review of the data on rejected contaminated lots, demonstrates that there has been a meaningful reduction on a sustained basis as follow:

- The numbers of rejected lots within the contamination range of 4-15ppb have decline from 112 lots in 2004, to 48 lots in 2007, a significant decrease of 57% on the number of such lots in 2004.
- In 2007 the number of rejected lots in the 15-50 ppb contamination level bracket decreased to 55 lots, compared to those in the same contamination level bracket from 2004 at 161 lots, an almost 3 fold decline during that four-year period!
- The numbers of rejected lots with a contamination range of 50-100 ppb declined to 10

Lots in 2007, whereas in 2004 some 139 lots were rejected by EU countries, this is a staggering decrease of almost 14 fold in a 4-year period.

- In 2007, 8 Iranian pistachio lots were rejected due to levels of contamination greater than 100ppb of total Aflatoxins, while 148 lots had been rejected in 2004; this corresponds to 18.5 times decrease in the frequency of such lots during this period.

Overall we can say that the tastes of Iranian pistachio consumers are sensitive to aflatoxin issue and therefore the producers is required, take an attention to this issue as an important factor in the marketing. The first step in this regard is assessing the knowledge of growers on aflatoxin in pistachio that in the current study has been investigated.

## **MATERIALS AND METHODS**

Samples were selected through a random sampling method from the pistachio farmers in Kerman province. For this purpose, at the first step the townships of Kerman, Sirjan, Rafsanjan and Zarand were chosen. Then some villages randomly were determined in the selected township. In the next phase, in each village, some farmers (depending on population) were randomly selected. In total 553 questionnaires were completed. For analysis and comparison of the results, statistical calculating and average comparison methods were used.

## **RESEARCH FINDINGS**

### **A - General profile of sample**

General characteristics of the sample have shown in table 1. As the table 1 shows, all the three factors, the space between the two rows of trees, the distance between the trees in each rows and number of trees per unit area, showing the high density of pistachio trees in cultivated area. While the scientific density of cultivation of pistachio orchards is at least 450 trees per hectare and the maximum are 600 trees per hectare. The average age of pistachio trees in the sample was 24, which are in economic fruiting period. Also, table 1 show that more than 70 percent of the samples have used the Badami variety as rootstocks. As shown in the table nearly 100% of the samples using flooding irrigation system. Water volume consumption was 7719 cubic meters per hectare per year within a 44 day period. Water quality is in the range of none and brackish water. While, the optimum volume of water consuming in pistachio orchards with salty and brackish water (without considering the problem of leaching) is 8-9 thousand cubic meters per hectare per year. So it is seen that the limitations of water, is one of the characteristics of the sample.

**Table 1: General characteristics of the sample**

Variable Name	The sample mean
Distance between two tree in rows (m)	5.1
Distance between rows of trees (m)	1.5
Number of trees per unit area (ha)	1278
Age of trees (years)	23.70
Basic rootstocks	71.53 Badami 28.47 Ouhadi
Type of irrigation system used	100 % Flooding
Water volume (m <sup>3</sup> /ha/year)	7719
Irrigation interval (days)	44
Salinity of irrigation water (µ mouse)	39.4 percent lower than 5000 48 percent between 5000 to 8000 12.6 percent higher than 8000
Processing unit type	87.9 % home traditional 7.47 % semi-mechanized 4.63% percent mechanized

Source: research findings

Based on the table 1, nearly 90 percent of the pistachio samples are taken from traditional processing units. While the semi-mechanized and mechanized processing units shares are very low.

**B - Technical and health status of the studied orchards**

Technical and health status of the studied pistachio orchards are recorded in Table 2. As this table shows, in terms of culture conditions, also mentioned in the previous section, suitable density in the studied area is not dominant. In other words, high concentration of pistachio orchard, provide a conducive condition for aflatoxin contamination and while, in the current condition, it is not possible to demonstrate a short-term solution to address the issue. That is because, the orchards are already established and the issue of the concentration should be considered for construction of

new orchards. Among other factors presented in the table 2, only the factor of “the last irrigation” before harvest is not in good condition. But this factor is not under the control of the farmers, because irrigation water in the area is received according to the share of each farmer in a specific period. In other words, the date of water provision is not determined by the individuals and it is determined according shares system. While the other factors presented in the table 2 are almost in the middle to high level. In other words, in cases where the farmers run the ability and knowledge about the methods of dealing with aflatoxin contamination, have been observed. All we can say in the terms of improving health and technical conditions in pistachio orchards, with current knowledge it is impossible to improve the situation greatly. In other words, farmers, considering the health and technical issues in respect to the level of their knowledge and it should be improved their knowledge.

**Table 2: Technical and hygienic status of pistachio orchards studied in terms of creating potential aflatoxin contamination (unit: percent)**

Variable Name	Average	Good	Bad	Very bad
Orchard density status	24.27	17.33	22.36	36.14
Orchard pruning status especially pruning of lower branches	45.80	41.24	8.94	4.02
Weed Control Status	43.32	36.43	18.58	1.67
Status of orchard floor management methods of soil tillage in time of harvest	52.72	28.67	17.51	1.11
Status of last irrigation before harvest	44.84	8.44	42.58	4.14
Pest and disease control situation	52.08	17.80	27.78	1.34
Nutrition status	46.38	38.40	13.93	1.29
Time status between harvesting and processing	40.34	40.15	12.44	7.07

Source: research findings

**C - General and technical knowledge of the growers**

In Table 3, the status of general and technical knowledge of the studied growers has been shown.

Variable Name	Very low	Low	Average	High	Very high	Below average
Technical information on aflatoxin	20.58	30.14	35.66	11.39	2.5	5.72
Effects of aflatoxin in pistachios trade and prices	12.08	23.99	34.79	24.17	4.94	36.07
Aflatoxin risk to human health	13.88	29.25	37.77	15.18	3.88	43.13
Effects of factors affecting aflatoxin contamination of pistachio nut	12.04	33.39	35.42	16.78	2.37	45.43
Important problem of aflatoxin in comparison with other problems	10.48	28.03	33.09	23.86	4.52	38.5
Plant residue impact on increasing contamination of pistachio to aflatoxin	10.25	37.36	35.16	15.22	2.01	47.61
Effect of lower branches pruning on aflatoxin contamination	7.32	30.58	36.63	21.24	4.23	37.70
Measures to reduce contamination in pistachio orchard	10.94	31.38	39.05	15.53	3.1	42.32
Effect of harvesting time on pistachio shell stating and increasing of contamination	6.77	22.71	42.67	24.72	3.13	29.48
Impact harvesting methods, collection and transport on contamination	5.83	23.17	46.71	21.35	2.94	29
Effect of delayed in processing on contamination	6.56	18.24	40.69	31.23	3.28	24.8
Effect of processing unit type on contamination level	5.83	21.35	35.76	33.57	3.49	27.18
Effects of floating tank on reducing of contamination	5.32	17.79	37.98	36.88	2.03	23.11
Effects of sorting in inspection belt on contamination rate	16.08	23.98	37.8	20.47	2.39	40.06
Effect of drying methods (sun drying and mechanical drying machines) on the level of contamination	7.18	22.28	39.24	28.54	2.76	29.46
Effects of processing unit hygiene from point of view of labor, building, machinery and other factor of contamination	4.97	18.04	42.72	28.54	5.73	23.01

**Table 3: The rate of general and technical knowledge of pistachio growers about aflatoxin (unit: percent)**

Source: research findings

Priority Number	Variable Name	Percentage of growers that have information less than average
1	Technical information on aflatoxin	50.72
2	Plant residue impact on increasing of contamination	47.61
3	Effects of factors affecting on aflatoxin contamination of pistachio nut	45.43
4	Aflatoxin risk to human health	43.13
5	Measures to reduce contamination in the orchard	42.32
6	Effects of sorting in inspection belt on contamination rate	40.06
7	Important problem of aflatoxin in comparison with other problems	38.5
8	Effects of lower branches pruning on level of contamination	37.9
9	Effects of aflatoxin in pistachios trade and prices	36.07
10	Effect of harvesting time on pistachio shell stating and increasing of contamination	29.48
11	Effect of drying methods (sun drying and mechanical drying machines) on the level of contamination	29.46
12	Impact harvesting methods, collection and transport on contamination	29
13	Effect of processing unit type on contamination level	27.18
14	Effects of floating tank on reducing of contamination	24.8
15	Effects of floating tank on reducing of contamination	23.11
16	Effects of processing unit hygiene from point of view of labor, building, machinery and other factor of contamination	23.01

**Table 4: prioritize extension needs of various issues regarding the pistachio aflatoxin**

Source: research findings

The final results of the table 3 are gathered in the table 4. In this table, the factors are prioritized according the bases of the lower average technical knowledge of the farmer. The same priorities can be considered in the appointing of priorities on the information provisions and promotion activities on the factors. In other words, as farmers' information is less on an issue, the priority of that issue is more on the matter

of improving information. As the table 4 shows, the major priority factors for extension services are technical factors such as technical information about aflatoxins, the effect of plant surplus, factors affecting fruit infection and their risk to human. In the second step of extension services, factor associated with the orchards and after the processing units is located. While the factors related to the processing units are in

the final priorities. This makes clear the two matters. At first shows that previous activities has been effective and provide necessary information to farmers. The second result indicates less necessity for information in the processing units. Now if according the table 1 the semi-mechanized and mechanized units are used less, it was because of the inability of farmers to use them, not for having enough knowledge in this regard. So, in general we can say at the first step, it is necessary speed up the technical extension services comprising definition aflatoxin, the effect of that in human health and ..., Step of after processing units and pistachio market is in second rank and orchards are in the third priority. The processing units, although, according the table 1 are traditional, but there is enough information about them. So it is necessary to try to solve their financial problems.

## RESULTS AND DISCUSSION

The results show that one of the main factors for having potential aflatoxin contamination is the high density in pistachio orchards. As the orchards are previously constructed, there is not possibility to change in current orchards. Therefore, this issue must be considered in the construction of new orchards. Amongst the other issues, there is limited water resources, that can not be solved in the short term program, and in long term program with considering the improvement of water resources ratio to pistachio orchards will be solved. Most studies show that farmers according to their limited knowledge comply with health issues and there was no negligence. In other words, the main issue that makes failure to perform health issues related to pistachio was because the lack of enough knowledge in some instances. In other words, increasing the knowledge of farmers, will lead to improving health and reducing pistachio aflatoxin contamination. A survey in extension services priorities indicated that technical information comprising the definition of aflatoxin, and its effect on health should be at the first priority. Next stage of the processing units and pistachio markets are at the second priority and pistachio orchards are the third priority. Processing units, although, according the table 1 are traditional, but enough knowledge existing on them. So it is necessary try to solve their financial problems and executive action.

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