FRUCOM position on possible setting of levels for Ochratoxin A for nuts, dried fruit and seeds

FRUCOM, the European federation of the trade in dried fruits and edible nuts, has always followed developments in the EU regulatory approach on Ochratoxin A and has actively participated and expressed its views & concerns in the successive OTA forums organised by the European Commission since 2001.

It is our understanding that the Commission does not intend to modify maximum levels currently in place, such as the one for dried vine fruit, as they are considered appropriate. This is in direct line with our long-standing views.

We however would like to express our surprise and the major concerns of the dried fruit, nuts and oilseeds sector, both in importing and producing/exporting countries, regarding the possible setting of maximum levels for Ochratoxin A in all these products other than dried vine fruits. In this respect, we wish to stress the importance of taking into close consideration the following elements before engaging into any further regulatory steps:

- Currently regulatory limits for Ochratoxin A (OTA) cover a range of products including cereals, coffee, wine, grape juice, and spices in addition to dried vine fruit (DVF). The exposure to OTA due to consumption of dried fruit, nuts and oilseeds is minimal for the vast majority of consumers. In 2006, it was calculated that dried fruit including dried vine fruit were found to contribute only to 3% of overall OTA intake. Levels were introduced for DVF, main product as regards quantity consumed in the category of dried fruit. **The overall contribution of remaining products in this category was found to be minimal**. Nuts/oilseeds were not even considered, and their consumption is lower compared to DVF even in the highest consuming countries. For import statistics please see the Annex.

- We believe that further extension of limits on the level of OTA in dried fruit, nuts and oilseeds is going to lead to a decreasing effectiveness in protecting consumer health, whilst significantly increasing costs to the sector. This is predominantly because controls over the levels of OTA in these products are more difficult to achieve, and less effective in outcome, leading to an inevitable position where costs of testing and rejection will increase at a faster rate than the benefits obtained. For example, due to non-homogeneous OTA presence there is a difficulty to perform an adequate sampling, especially for small lots, which will lead to reliable testing results. However, the Commission indicated that sampling procedures that are in place for aflatoxins will also be used for OTA - please see our detailed comments on the practical implementation below.

The extremely low consumption of dried fruit other than dried vine fruit, nuts and oilseeds in the EU suggests that there is no obvious need for regulatory measures on all these products:

- The overall consumption of dried fruits by the European population is very low (2.9 g per day according to WHO-GEMS/Food, 2003) and cannot stand comparison with any of the major food products consumed in the EU that are major contributors to OTA exposure. Moreover, the consumption of each type of dried fruit is very unevenly distributed throughout the EU, products' preferences and consumption habits varying strongly from one Member State to the other.

- This very low consumption of dried fruit other than dried vine fruit by European consumers strongly suggests that consumer exposure to OTA due to these specific products is very minimal, as shown by several OTA scientific assessments. In support to this approach, we recall that the EFSA OTA risk assessment released in 2006[1] did not even consider the specific case of dried fruits or nuts because of their low rate of consumption: "*the current update considers seven food categories representing the main contributors to OTA exposure, identified by the SCOOP report and by JECFA. These categories are cereals and cereal products, wine, beer, grape juice, brewed coffee, cocoa and cocoa products as well as pork meat. ...**Dried fruits*** and spices ***are not considered because of their low rate of consumption of 2.9*** and 0.5 *grams per day, respectively (WHO-GEMS/Food, 2003)".* **Nuts/oilseeds are not even mentioned in EFSA opinion; no calculation has been performed by EFSA to help establish a potential level.**

EFSA concluded in its opinion that "the observed effects are dose- and time dependent"; however, due to low consumption of dried fruit and nuts long time exposure is very unlikely.

To recall:

- The Tolerable Weekly Intake (TWI) of OTA in food has successively been evaluated by:
  - the Join FAO/WHO Expert Committee on Food Additives (JECFA),
  - the Scientific Committee on food (SCF) and
  - the EFSA Panel on Contaminants in the Food Chain (CONTAM)

  ° In 2001, JECFA arrived at a Tolerable Daily intake (TDI) of 16 ng/kg b.w., which was converted to a Provisional Tolerable Weekly Intake (PTWI) of 112 ng/kg b.w. In 2005, this PTWI was finally rounded off to 100 ng/kg b.w.

  ° In 1998, considering the then-concerns about potential genotoxicity of Ochratoxin A and its mechanism of action as a carcinogen, the SCF considered as prudent to ensure exposures towards the lower end of the range of TDI of 1.2-14 ng/kg b.w.

  ° On 4 April 2006, in the light of more recent toxicological studies and exposures data, showing amongst others the lack of evidence to demonstrate the existence of specific OTA-DNA adducts, the EFSA Panel on Contaminants derived a higher TWI of 120 ng/kg b.w.

  Considering the data from the report on the "Assessment of dietary intake of Ochratoxin A by the population of EU Member States" published in January 2002, the current levels of exposure to OTA vary between 15 and 60 ng/kg b.w. per week, which is well below the established TWI. This evaluation took into account both average and high consumers of foods that are the main contributors to OTA exposure.
- As far as dried fruits are specifically concerned, the report on the "Assessment of dietary intake of Ochratoxin A by the population of EU Member States" stated that their contribution (including the one of dried vine fruit) to the total OTA exposure of European consumers is only of 3 %.

[1] Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to Ochratoxin A in Food, Question N EFSA-Q-2005-154, p.44

The EFSA 2010 Statement did not change previous conclusions.
Also, there are no CODEX maximum levels for OTA in dried fruit/nuts.

Consequently, it is very likely that regulatory measures establishing maximum levels for OTA in all dried fruit, nuts and oilseeds would in practice only have quasi-inexistent benefits for European consumers, even those highly consuming these products.

In view of these elements, we therefore do not see at present any tangible justification and necessity for the introduction of OTA maximum levels on dried fruit other than dried vine fruit and on nuts. Moreover, we do not understand how public authorities could favour the introduction of measures that would most likely not have major impact in terms of consumer protection but would certainly highly disrupt the activities of the dried fruit trade and industry. Preventive measures designed to protect European consumers should certainly not lead to overregulation when their real benefits for European consumers' health is actually not demonstrated. We strongly believe that regulatory measures should only be enacted in situations where a prior and precise risk assessment has demonstrated not only the existence of a real problem needing to be tackled but also the direct effects in terms of risk reduction and benefits for European consumers that would be brought by the introduction of such measures.

We provide in the Annex the information at our disposal regarding:

1. Brief overview of OTA in various dried fruit and nuts
2. Detailed information on figs, including summary of the research projects on OTA in figs
3. information on pistachios
4. Import statistics for dried fruit and nuts

We also include test results for OTA in a range of dried fruit and nuts provided by our members.
Our conclusion is that for none of the products, the scientific calculation of TDI/TWI in relation to the consumption has been made by EFSA, and this should be the basis of proposed levels, if any, for them to be scientifically substantiated.

FRUCOM commissioned an expert study on the impact on potential consumer exposures to ochratoxin A from the proposed setting of maximum levels for certain dried fruits and nut products, in accordance with EFSA methodology, which is shared with the authorities.

Today, the research on OTA in figs appears to be one of the more comprehensive of the category "dried fruit, except DVF, and nuts". It accordance with the findings, OTA contamination in figs is not linked to inappropriate storage; it is difficult to manage prior to harvest, implementation of GAP had no marked effect on OTA contamination frequency or concentrations, the frequency of OTA varies more than aflatoxins, OTA and black mould relationship is of lower significance. All these factors make it impossible at present to introduce levels as low as reasonably achievable.

Overall, FRUCOM is of the opinion that, in view of the limited and incomplete information at hand, it is too early to start discussing the setting of maximum limits for all dried fruit other than dried vine fruit, nuts and oilseeds and that further data collection is required. It is more than likely that any establishment of such maximum levels in the present circumstances would only result in damaging the industry, the trade and the production of these products without achieving an appreciable improvement in consumer protection.

Practical implementation: difficulties in application of the Regulation 401/2006 on sampling and analysis

It is stated in the EFSA opinion[1] that OTA that "the random nature of fungal contamination of raw material (such as cereals, fruit and coffee) and thus the uneven distribution of subsequent OTA contamination is a major issue". "In general, literature data on the occurrence of OTA frequently fails to supply adequate detail as to the selection of samples, and ***one needs to guard against skewed data if targeted samples e.g. only suspect samples were analysed".***

- Regulation 401/2006[2]sets out the methods for analysis for aflatoxins, which we understand will be used to analyse ochratoxin A. it establishes that for example for figs, which are notorious for uneven distribution of OTA contamination, groundnuts and nuts for consignments up to 15 tons, there should be up to 100 incremental samples taken, aggregated samples of up to 30 kg, mixed, divided into laboratory samples, separately ground finely and mixed thoroughly to achieve complete homogenisation. The same Regulation establishes that if it is not possible to follow above rules, alternative method may be applied, provided it is as representative as possible and is fully described and documented.

- From a practical perspective, these stringent rules are not always being followed in practice at the moment of sampling. Product specific sampling methods are important.

- There is no study that shows aflatoxin sampling will prove the same for OTA since the frequency and levels vary widely according to the product and the year. The sample size of 30 kg can be appropriate if a joint analysis of aflatoxins and OTA is done in one lot. If there is a need to take two 30 kgs from a small lot, then there will be a significant loss. If the sample size is smaller, the accuracy will be in discussion.

- Furthermore, as demonstrated in the recent case of dried vine fruit, even if the consumption and contribution to the diet is low, the product was placed on the special measures after a very small number of exceedances (6 RASFF). This means that at least 5% of all consignments will be compulsorily checked **at the border**, which places practical constraints on the sampling.

[1] Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to Ochratoxin A in Food, Question N EFSA-Q-2005-154, p.9

[2] Commission Regulation 401/2006 laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs

- The EU Commission has reminded FRUCOM that it is the Member States' competence to enforce the controls. We doubt however that it is possible and proportionate to carry out testing in line with the existing protocol at border crossings. Non-adherence to sampling protocol will result in false positives, undue rejections and consequently, maintain this product on the special measures with no benefit for the consumer.

- **Any reflection on the levels to be set for OTA need to take into consideration the discussion on sampling, and a thorough analysis of the sampling protocols used when exceedances are being reported.**

In conclusion, FRUCOM's major concerns on the proposed establishment of OTA maximum levels in dried fruit (other than dried vine fruit), nuts and oilseeds are:

- The overall consumption of these products in the EU is marginal compared to other food commodities. The resulting OTA exposure of European consumers due to these products is therefore minimal and, all things considered, do not constitute a major threat to consumers' health that would call for stringent regulatory measures.
- It is not based on sufficient and detailed information that demonstrates an obvious need for regulatory measures.
- OTA maximum levels should only be set provided that a comprehensive and detailed risk assessment clearly demonstrates a reduction of the real risk for European consumers.
- In view of the lack of information on the OTA contamination of each of these products, their daily intake and the risk of OTA exposure related to their consumption, the setting of a maximum limit for all dried fruits or for all nuts/oilseeds does not seem currently justified.
- Any discussions on OTA maximum levels should take account of the existing technical limitations existing for the control of OTA contamination in these products, as well as the sampling protocols

ANNEX to
FRUCOM position on possible setting of levels for Ochratoxin A
for nuts, dried fruit and seeds

Part I

BRIEF OVERVIEW OF OTA IN VARIOUS DRIED FRUIT AND NUTS

Dried Fruit

- **Dried Figs (Ficus domestica):** There are technical difficulties involved in managing OTA levels in dried figs. We note two major areas of concern, one being the limited consumption and therefore dietary exposure to OTA from consumption of dried figs, and the second being the natural process of the fruit being pollinated by a parasitic wasp, that can inoculate the fruit with ***Aspergillus spp.*** in doing so.

  Figs are partially dried on the tree as the dates. OTA starts on the tree even before fig fruits become mature. Aflatoxins start at maturation.

  OTA contamination in figs is not linked to inappropriate storage and is difficult to manage prior to harvest.

  For all fig varieties and for some date varieties the skin is not protective as it is in vine fruit.

  It is well known that the presence of black mould spots in dried figs does not always indicate high occurrence of OTA. Very roughly around 40 % of black mould are Ochratoxigenic and may produce OTA if all conditions are suitable. The frequency of OTA contamination in figs can differ significantly according to the crop year and to the quality of the products, hot and humid years being more difficult. Important variations of OTA contamination are function of the presence of different ochratoxigenic fungal species and the different virulence between the strains.

  In figs, the frequency of OTA varies more than aflatoxins. Aflatoxins may vary between 1-2 % yearly. There is no correlation of OTA/AFLA, therefore the measures currently applied to reduce AFLA contamination will not automatically reduce OTA.

  Bright greenish yellow fluorescence and aflatoxin production has a higher correlation and 90 % of fluorescence is on the outside.

  Moulds may develop inside the fruit cavity and not be visible from the outside. Consequently, moulds cannot be easily sorted out and removed from the lots.

  For these reasons, it is widely assumed that some mould contaminated fruit is inevitably to be found, as accounted for in the UNECE specification for dried figs. It is immediately evident that control techniques do not at present exist, and that it is very difficult to envisage how they could be developed.

- **Dried Dates (Phoenix dactylifera):** Dried dates, as the figs, are dried whist still on the palm. This makes these two products different to all other fruit. This again exposes the fruit to insect activity and inoculation of the fruit with ***Aspergillus spp.*** by insects which can again lead to some OTA residues.

- **Dried Stone Fruit (Prunus spp.):** The key products in this group are Dried Apricots and Prunes, with a very small amount of Dried Peaches consumed. As such it is the most consumed group of dried fruit after dried vine fruit. All fruit are characterised by a small hard pit. Removal of this part always results in a certain degree of injury to the fruit, and this occurs at a stage where the Aw is in the range at which the ***Aspergillus spp.*** that lead to OTA contamination are active. To counter this the majority of fruit in this group is treated at or before the time of pitting with either Sulphites, or Sorbates as preservatives. The limited results available suggest that this is a very effective control against mycotoxin contamination, and that OTA limits on these fruits are unnecessary from a health protection standpoint.

- **Dried Pome Fruit (Malus spp., Pyrus spp.):** Again consumption of dried apple and dried pear are relatively limited in the EU. Again, this material is almost exclusively treated with sulphites and we are unaware of any issue with OTA contamination.

- **Dried Tropical Fruit:** These are exclusively produced in developing countries with low levels of infrastructure for testing. Consumption levels are very low. It is also believed from study of distribution routes and marketing materials that most these products are aimed at adult consumers. In this instance, our opinion is that the low consumption rates suggest that even for the most exposed consumers the exposure from this route is extremely low, and the imposition of a regulatory limit would be disproportionate in terms of benefit and cost/ market disruption.

- **Preserved and Dehydrated Fruit (Infused pineapples, papaya, mango, cherries, blueberries, cranberries):** Processed fruit of this type is generally infused with sugar, concentrated fruit juice or similar materials to significantly raise the brix and lower water activity prior to drying. Fresh or frozen fruit is taken in by the factories and processed prior to drying. Consequently, fruit is not subject to conditions suitable for mould growth and mycotoxin formation for a significant period of time. In this instance we see no technical justification for a regulatory limit for OTA.

Nuts:

- At present, limited information on the presence of OTA is available. For **hazelnuts,** the information supplied by our members suggests that all available test results are negative. No RASFF notifications or alerts have been detected since 2001 on **walnuts, hazelnuts, cashew nuts, Brazil nuts, macadamias, pecans and pine nuts.** Including nuts which had no positive samples will create an unnecessary problem in trade and increase the cost.

- In nuts, the OTA incidence varies according to the types. The risk for in-shell nuts with hard shells is very low.

- As regards **pistachios,** information provided by our member is included further in this Annex. Other separate studies and sampling results referenced below showed limited positive findings. It was concluded that the frequency of OTA contamination in pistachio samples available in the Spanish market is relatively low[4]. Although in Germany[5] some samples tested positive, the German National Institute for Risk Evaluation concluded that it did not expect any negative effects for the consumers.

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https://www.ncbi.nlm.nih.aov/pubmed/24779573: A survey of the fungal contamination and occurrence of aflatoxins and ochratoxin A (OTA) in 50 pistachio nut samples collected from commercial stores, Spain; only one sample of pistachio showed OTA contamination at 0.67 pg/kg.

[5] http://www.cvuas.de/pub/beitrag printversion.asp?subid=1&Thema ID=12&ID=1666&Pdf=No&lang=EN: In 2012 oil seeds (poppy, sunflower, pumpkin, and flax seeds) as well as pistachios and pine nuts taken from the administrative districts of Stuttgart and Karlsruhe were analysed at CVUA Stuttgart for the presence of Ochratoxin A (OTA). A total of 89 samples were analysed.

Part II

OCHRATOXIN A INVESTIGATIONS IN DRIED FIGS AND RESULTS

1. Introduction

The Aegean Exporters' Associations (EIB), closely follow the developments in the European Union, which is the greatest buyer of Turkish dried figs with about 50%. Additionally, the scientific research work/surveys starting from the orchard up to the final product are carried out together with Ege University Faculty of Agriculture (EUZF) since 2005. Samples are taken from processing plants at raw material stage to find out the annual contamination and also data are collected from laboratories for monitoring purposes by the Association.

In dried figs, OTA is mostly formed by *Aspergillus niger* group of black spored moulds. In rarer conditions OTA may also be formed by Penicillium spp. moulds. Due to presence of multiple factors, OTA may occur in both hot and dry conditions as well as lower temperatures like 5 °C. Since the fig fruit develops and ripens in summer, the main ochratoxigenic fungi is the drought and heat tolerant black spored Aspergillus group. OTA forms in figs at the fruit development stage before maturity. However, its concentration increases as ripening progresses in fruit and thereafter with drying. Contamination generally occurs during caprification (pollination) and fungi develops within the fruit. On the other hand, every black mould is not ochratoxin producer. Therefore, in dried figs OTA is a contaminant self-induced in nature and the frequency and concentrations may vary with the climatic conditions prevailing during fruit growth, maturation and drying. The levels and frequency may increase with adverse climatic conditions resulting in year to year variations.

2. The results

The results of the surveys carried out by EIB in cooperation with EUZF are presented in the following tables. The method used in analyses being Rhone IFU-2001, Recovery is 90-92% and Limit of Detection is 1 µg/kg.

Table 1. OTA analysis results of the raw material dried fig samples mostly taken at the beginning of the season from the dried fig processing plants between the years 2005-2009 within the scope of the mycotoxin monitoring studies

	2005		2006		2007		2008		2009	
OTA (µg/kg)	No.of Samples	%	No.of Samples	%	No.of Samples	%	No.of Samples	%	No.of Samples	%
Not detected	49	74,24	60	78,94	20	86,95	13	43,3	36	76,9
< 10	10	15,15	10	13,15	1	4,34	12	40	5	11,4
> 10	7	10,60	6	7,89	2	8,69	5	16,7	3	6,9
Total Number of samples	66	100	76	100	23	100	30	100	44	100

Table 2. OTA analysis results of the raw material dried fig samples taken from processing plants between the years 2010-2016 (excluding 2012-2014)

	2010		2011		2015		2016	
OTA (μg/kg)	No.of Samples	%	No.of Samples	%	No.of Samples	%	No.of Samples	%
Not detected	58	100	41	85,41	46	73,01	25	45,45
< 10	-	-	5	10,41	8	12,69	20	36,36
> 10	-	-	2	4,16	9	14,28	10	18,18
Total no.of samples	58	100	48	100	63	100	55	100

The monitoring was carried out under a project, which targeted occurrence of mycotoxins including OTA. The project ended in 2011 which explains the data gap. However, the Aegean Dried Fruit Exporters' Associations Executive Board decided to continue a monitoring program for Aflatoxins and OTA after 2014. Samples have been randomly taken, analysed and disseminated to the members every year for monitoring purpose. The results are evaluated by the scientific consultants and shared by all members of the Aegean Exporters Association and when necessary with the Ministry of Food Agriculture and Livestock.

The data do not point out to the climate change effect.

Table 3. OTA results of the final products of dried figs analysed in accredited laboratories between the years 2012-2016 (private requests)

	2012		2013		2014		2015		2016	
OTA (μg/kg)	No.of samples	%	No.of samples	%	No.of samples	%	No.of samples	%	No.of samples	%
Not detected	144	80,89	156	82,97	131	87,91	210	81,39	259	86,62
< 10	26	14,60	25	13,29	14	9,39	29	11,24	32	10,70
> 10	8	4,49	7	3,72	4	2,68	19	7,36	8	2,67
Total no.of samples	178	100	188	100	149	100	258	100	299	100

PROJECT TO DETERMINE THE EFFECTS OF GOOD AGRICULTURAL PRACTICES ON PREVENTION/REDUCTION OF MYCOTOXINS IN DRIED FIGS

1. Rationale and objective

During the monitoring of mycotoxins in dried figs carried out since 2005 season by the Dried Fruit Board of the Aegean Exporters' Associations (AEA), OTA was found at detectable and variable concentrations in the raw material in processing plants. Upon consultations, the AEA decided to support the Project proposed by Ege University and the Ministry of Food Agriculture and Livestock to introduce GAP in dried fig production, study the occurrence at the orchard level and during drying and evaluate the effect of GAP on mycotoxin incidences.

2. Project implementation, brief methodology and results

The Project was implemented by Ege University Faculty of Agriculture Department of Horticulture (Bornova-IZMIR) and Erbeyli Fig Research Institute (Aydin) of the Ministry of Food Agriculture and Livestock, between 2009 and 2012.

The Big and Small Meander Basins are the main dried fig production region in Turkey. The production region lies from west to east mostly on a mountain range. All Turkish dried figs come from a single variety, Sarilop (=known as Calimyrna in California-USA) grown under rain-fed and low-input systems. Ten fig orchards were selected from different locations and altitudes (Table 1) representing the production area. The Codex Code of Practice for prevention/reduction of aflatoxins and GLOBALGAP principles were used as the guidance documents in developing the GAP protocols. In each orchard, a GAP experimental plot was established. Soil samples were taken from 0-30 and 30-60 cm depth. A questionnaire was filled out with the farmer on the cultural practices and inputs applied to analyze the history of the farm. The project provided the inputs e.g. fertilizers, clean caprifigs, harvesting boxes, drying trays and required infrastructure e.g. clean room for selection and storage of figs to the farmers. Trainings were performed, pamphlets and posters distributed to these farmers to explain the critical points and measures to be taken in GAP. Adjacent ten orchards under the same soil and ecological conditions managed by another farmer where all decisions for input use and cultural practices were made by the farmer himself were used as controls to collect comparative data/samples.

Table 1. Location (Village/Town in Aydin and Izmir Provinces) and altitudes of the experimental orchards

Kizildere village / Buharkent **N 37° 57.062' Altitude185 m** **E 028 ° 47.907'**	**Haydarli /Nazilli** **N 38º 01.062' Altitude 553 m** **E 028º 27.251'**
Haskoy/Nazilli **N 37° 59.053' Altitude 695 m** **E 028 °17.335'**	**Isafaklar/Incirliova** **N 37° 56.755' Altitude 501 m** **E 027 °42.611'**

Me§eli/Incirliova **N 37° 56.716' Altitude 431 m** **E 027 °41.006'**	**Akmescit/Tire** **N 37° 59.763' Altitude 687 m** **E 027 °40.889'**
Dampinar village/Germencik **N 37° 58.520' Altitude 456 m** **E 027 °35.099'**	**Egri Kavak/Aydin** **N 37° 56.682' Altitude 759 m** **E 027 ° 59.125'**

Mursalli/Germencik **N 37° 51.800' Altitude 46 m** **E 027 °35.012'**	**Bozkoy/Germencik** **N 37º 94.27968 Altitude 300 m** **E 027º 63.32163**

Data loggers recorded the temperature and relative humidity values during the fruit growth and maturation period. Soil and leaf samples were taken to analyze plant nutrient composition and specific fertilizer applications were made based upon recommendations of the experts after soil and leaf analyses. Fruit samples were collected at fresh maturity, partially dried (fallen onto ground on the same day or a day before), and as fully dried stage (from the drying trays) for quality and mycotoxin analyses. Dried fig fruit were collected at two different dates (beginning and late September) to evaluate the occurrence during the harvest season. Fruit samples were collected as triplicates and mycotoxin analyses were performed at the accredited laboratory of Aydin Commodity Exchange Bourse with Rhone IFU-2001 method.

Results based on analyses of samples collected for three consecutive years (2009-2010 and 2011) showed that Ochratoxin A was present at fresh maturity at lower frequency and low concentrations (< 1 ppb). Higher OTA frequencies and concentrations were found at partially dried and fully dried stages. The harvest time, early or late September, did not create any significant difference.

Implementation of GAP had no marked effect on OTA contamination frequency or concentrations. Yearly conditions were effective in determining OTA incidence and concentrations regardless of the location, altitude or the management system of the orchard, GAP or conventional.

There is little influence on managing OTA in the orchards despite GAP. Some decrease of levels from the raw material to finished product is nevertheless observed. This, however, does not mean that the levels can indeed be controlled. There is no significant correlation but removal of lower quality e.g. excessively dried, rotten, and especially fruit with black moulds during processing may contribute to some reduction of OTA levels. **Turkey already carries out extensive testing for aflatoxins for figs intended for export, but it does not automatically reduce OTA.**

OCHRATOXIN A (OTA) in PISTACHIOS

Ochratoxin A (OTA) is a naturally occurring fungal metabolite and mycotoxin produced by some ***Aspergillus*** and ***Penicillium*** fungi; ***Aspergillus*** appears to be the dominant producer in tropical and semi-tropical environments while ***Penicillium*** is more prevalent in cooler growing areas. ***Aspergillus*** fungi are classified into different taxonomic sections based on spore morphology; OTA-producing ***Aspergillus*** fungi are in the Circumdati section (Aflatoxin-producing Aspergilli are found in the Flavi section). Within each section, isolates may vary in the amount of toxins produced with some isolates being atoxigenic and others producing toxins.

OTA has been occasionally detected in pistachios and has received RASFF notifications about 12 times in the last 15 years. Following several notifications in the early 2000s, field research was conducted in 2006 and 2007 on potential OTA producing fungi. Fungi from the potential OTA-producing Circumdati section were found on pistachio hulls and in early split pistachio nuts. ***Aspergillus ochraceous*** and ***A. melleus*** were the most common Circumdati detected and no ***A. alliaceus*** fungi were found. This is particularly important because in previous research on other dried fruits, ***A. alliaceus*** produced OTA at relatively high levels while the other species frequently did not produce OTA. (This research is available in the research database at **www.acpistachios.org**)

OTA contamination and increase is unlikely to occur in storage or transport because the fungi require a water activity of >0.8. Pistachios are stored at a moisture percentage of 5-7% which corresponds to a water activity of <0.7. Higher water activities would lead to active mold growth that would render the pistachios unmarketable.

Aspergillus fungi are closely related and species in the different sections are likely to have a similar epidemiology. Consequently, it is reasonable to expect that the OTA-producing fungi behave similarly to the aflatoxin-producing fungi and that OTA contamination is more prevalent in insect-damage nuts. However, due to the rarity of OTA contamination in pistachios, prior research was not extensive enough to conclusively determine OTA epidemiology. In addition, the pistachio-producing areas of California have seen significant changes in the composition of neighboring crops over the last decade and research is likely needed to determine if the relative contamination risk has changed accordingly. A geographically and quality related survey is being planned for the 2017 harvest.

Setting arbitrary limits on pistachios for OTA is not supported by existing research or risk assessments.

PART IV STATISTICS

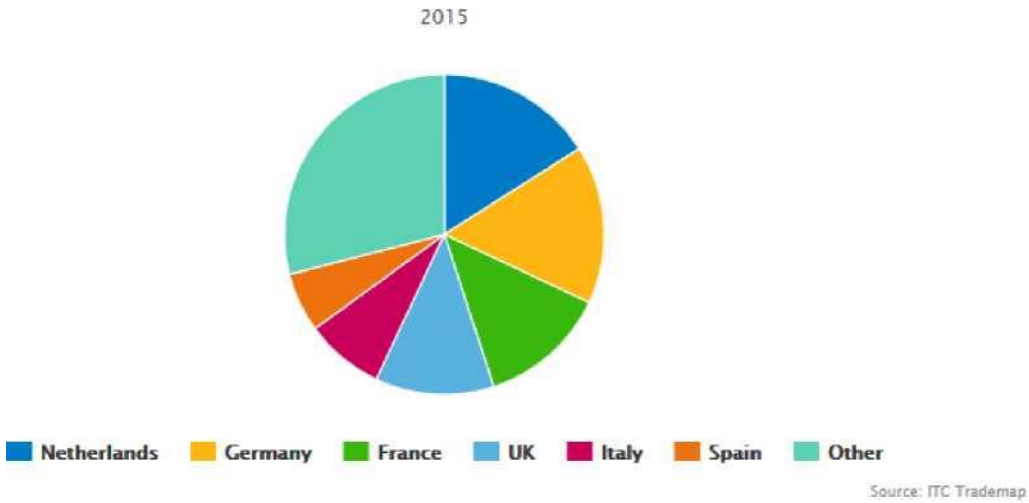
IMPORT INTO THE EU

EU Import of dried fruit in 2015		
	Import Qty (t)	
Dried vine fruit	328,600	58%
Dried bananas	3,300	1%
Dates	97,520	17%
Dried figs	28,806	5%
Dried apricots	28,079	5%
Prunes	55,900	10%
Dried apples	11,117	2%
Candied fruit	8,959	2%
TOTAL:	562,281	100%

EU Import of nuts in 2015		
	Import Qty (t)	
Almonds	231,304	30%
Walnuts	104,951	14%
Pistachios	77,498	10%
Hazelnuts	189,207	25%
Cashew nuts	115,260	15%
Brazil nuts	17,782	2%
Macadamias	6,141	1%
Pecans	9,866	1%
Pine nuts	10,620	1%
TOTAL:	762,629	100%

Source: Eurostat

Imports of edible nuts and dried fruit by country in 2015, share of imported quantity



Source: Exporting edible nuts and dried fruits to Europe, CBI - the Centre for the Promotion of Imports from developing countries, the Netherlands
https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/edible-nuts-dried-fruits/europe/